Engineering and Mining Journal

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ENGINEERING & MINING WORLD

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NEW YORK LONDON

49

A step in Cerro de Pasco's 50,000-hp. hydro-electric project in Peru. Sinking sheet piling prior to building the cut-off wall

COST OF WORKING A GOLD PLACER OF MEDIUM SIZE

SURVEYING THE WITWATERSRAND FROM THE AIR

TUNNELING IN THE PERUVIAN ANDES

WHAT SHALL WE DO ABOUT SILICOSIS?

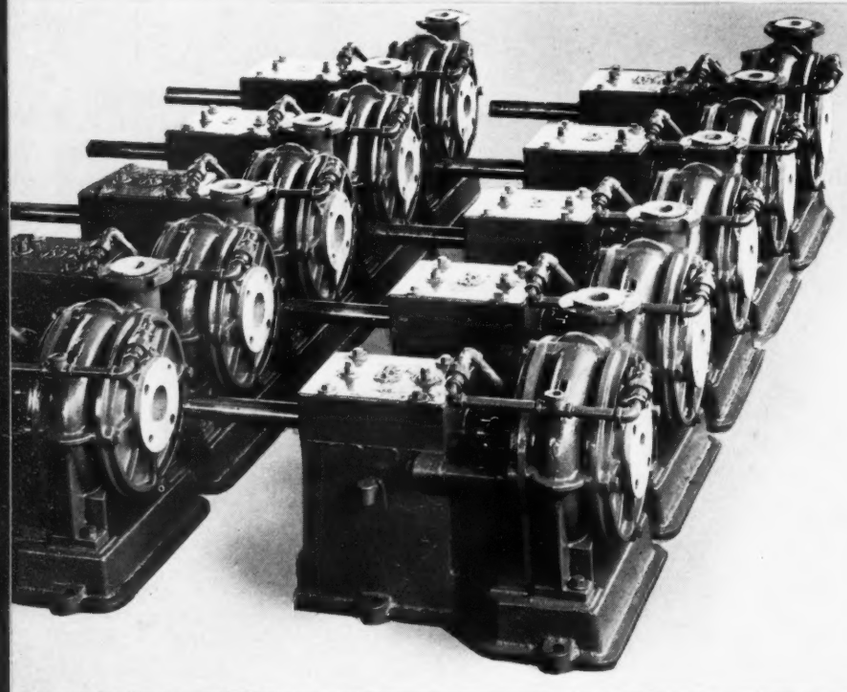
WORLD COPPER-ORE RESERVES

LABOR AND METAL COSTS

OCTOBER 1934

DOUBLE PROTECTION

AGAINST EXCESSIVE WEA



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H. C. PARMELEE
Editorial Director

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A. W. FISHER
Manager

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WILLARD CHEVALIER
Vice-President

CALIFORNIA GOLD. However November's skies may be, November's *E.&M.J.* will be devoted to the subject of gold in the Golden State. Mining, milling, metallurgy, statistics, and economics—all will be treated by a galaxy of able writers. The Editors hope to make the appearance of this issue an event in the life of miners on the Coast.

•

COVER DESIGN. Cerro de Pasco builds for the present and plans for the future. The power to be developed by the project illustrated will be used for operation and possibly for expansion later on. The cut-off wall, under construction in the picture, will rest on solid rock 140 ft. below the river bed, which is 12,505 ft. above sea level at this point. Excavation was begun by digging an open cut 68 ft. deep and sinking between piling below that depth. The dam itself is to be 225 ft. high.

•

FIRE AT SEA has taken an average toll of 25 vessels annually for the past ten years. The "Morro Castle" incident is likely to encourage the replacement of wood by metals and non-metallic materials of construction in ship building and furnishing. Aluminum and its alloys, asbestos, magnesite, mineral wool, copper, and zinc are available substitutes for wood in fireproof construction.

•

"SELL & SWITCH" methods of selling mining securities received a set-back recently when the Federal Trade Commission obtained injunctions in the Federal Courts of the New York area restraining two promoters from selling certain mining stocks. The business seemed to be profitable—to the brokers—in spite of telephone tolls amounting at times to as high as $300 per day.

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RISING PRICE of silver is responsible for speculation on the possibility of reopening the famous Silver Islet mine, in Lake Superior, discovered by Thomas McFarlane in 1866 and abandoned in 1884.

•

POPULAR PRESENTATION of a technical subject, admittedly difficult, is achieved in the August issue of *Fortune,* which carries the story of International Nickel. Artist and photographer have caught and faithfully reproduced the spectacular features of the technical processes.

•

FACILITIES FOR TRADING IN SILVER FUTURES are now available in Montreal. The practice has been suspended in New York, where it was a boon to speculators prior to "nationalization." The new Canadian exchange, which is the only open market for the metal in North America, has begun to function. The unit contract is 10,000 oz. New York's loss is the Dominion's gain, or is it?

•

"METALLIFEROUS." After years of toleration, we hoist a protest flag over the phrase "metalliferous mining." The Latin derivative means "metal bearing" or "metal yielding," with obvious reference to the metal-carrying substance. Even though "ore" be understood, the protested couplet is clumsy. "Metal mining" is much better.

•

A PACIFIC COAST steamship company, in the interests of safety, has signs on its piers reading "AVOID THAT RUN-DOWN FEELING—WATCH MOVING TRUCKS!" which might be paraphrased for the mining industry, "BLASTING IN PROGRESS, KEEP AWAY—AVOID A COMPLETE BREAK-DOWN."

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THE BEAR PUTS ON LONG PANTS

THE YEAR 1934 marks a big anniversary for Bear Brand Xanthates. Remember the early flotation days when "reagent" meant anything you hoped would get recoveries and mill men were trying everything from soap to sawdust? Xanthates were born into the mining world at that time—just ten years ago.

Those first xanthates came from the Great Western plant at Pittsburg, California and they got higher recoveries than any reagent ever had before. Today there is hardly one flotation plant the world over which doesn't depend primarily on xanthates for collectors.

The ten-year-old Bear feels a bit proud of his job to date and we hope you'll excuse the grin. Great Western engineers have consistently backed him up with improvements and have steadily developed new xanthates, until now he can point to six of them, each with outstanding selective properties. Singly and in combination these six are getting high recoveries from widely varying non-ferrous ores in all parts of the world. May we send you samples?

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H. C. PARMELEE, Editorial Director
New York: A. H. HUBBELL, H. D. KEISER, Associate Editors
H. H. WANDERS, Market Editor; W. N. P. REED, Assistant Editor
San Francisco: J. B. HUTTL, Assistant Editor; G. J. YOUNG, Consultant
Washington, D. C.: PAUL WOOTON

Volume 135 OCTOBER, 1934 Number 10

Business and Government At the Crossroads

IN HIS RADIO ADDRESS to the nation on September 30 the President showed that he was not unaware of a rising tide of criticism of the New Deal and a demand for clarification of its program. Such sentiments have found repeated expression of late by regional, industrial, and general business organizations such as the New England Council, the American Mining Congress, and the Chamber of Commerce of the United States. The sentiments are probably exaggerated and not always constructively expressed, but they exist and merit consideration. Having cooperated with the Administration for eighteen months in its plan for a partnership between business and Government, business is now in a state of apprehension over the current trend of governmental policies. The future, not the past, is the concern of the moment.

• First among the anxieties is the trend toward bureaucratic control of business that is becoming progressively entrenched as business men retire from their voluntary service in Washington and leave the field to political appointees. Successively there has been apprehension over the labor and monetary policies of the Government, its expanding program of competition with private enterprise, its heavy expenditures and consequent taxation, its attitude toward the profit system and the regimentation of business. In his radio address the President touched reassuringly on some of these matters, but neglected others. There is still apprehension in the mind of business that ought to be allayed if the partnership is to function most effectively.

• Strategy in the present temper of business lies neither in a retreat to pre-New Deal conditions nor in advance sharply to the Right or Left. We have no sympathy with the ultra-conservative and reactionary group that would ditch the New Deal and return to the fleshpots of Egypt. Neither can we approve the radical policies of those who would revolutionize our economic system and set up a wholly new and experimental régime. Domination by either group would be intolerable. Between these two, however, stands a progressive and enlightened group that has not only recognized and admitted the past existence of anti-social business practices and abuses, but which has cooperated with the Government for their elimination. In this group the Government should find sympathetic allies and welcome counsel.

• Mere denunciation of the New Deal will serve no useful purpose, for there is high salvage in its policies of value to honest business. It is, however, the privilege and duty of business organizations to define a constructive program based on experience of the past year, approving those policies it considers helpful, questioning those of doubtful value and opposing those believed to be destructive to sound recovery. Presented with such a program, the Government cannot decently refuse to pause in its plans long enough to audit the results, and chart a course in the light of a joint appraisal. For in the words of A. E. Morgan, director of the Tennessee Valley Authority and an ardent advocate of the New Deal, "To omit from the councils of men any sources of wisdom,

judgment, or experience, or to ignore the normal aspirations of any group in the determination of public policy, is to rob society of some of the quality it might possess."

• In all probability the situation is neither as good nor as bad as it is painted by its partisans, but there is no doubt that business and Government are at the crossroads. The inevitable transition period in the evolution of the New Deal has revealed its weakness as well as its strength, its mistakes as well as its accomplishments, and has brought criticism that should not be lightly ignored. Business has followed the Administration and has made, by and large, a sincere effort to cooperate in its policies. If it now expresses a lack of unbounded confidence in the future and a demand for policies that will make for greater stability it is entitled to a cordial hearing. Compromise and concession are in order on the part of the Government as well as of business, in the interest of recovery and prosperity. Otherwise the country may move forward to a blind and stupid test of strength between opposing groups, which can only be disastrous to the whole nation.

Mining Outlook

WHATEVER general business sentiment may be—and probably it is not as good as business conditions warrant—there are hopeful and encouraging signs on the horizon of the mining industry. Washington skies have cleared in the vicinity of the Bureau of Mines with the appointment of John Wellington Finch as Director. Secretary Ickes prevailed with the President in his desire to make a new appointment and in so doing inevitably assumed responsibility for the future welfare of the Bureau. Consequently we may look for the hearty support of the Secretary, harmonious relations between him and the Director, and a concentration on constructive policies that will make the Bureau most effective in serving the industry. The American Mining Congress in its San Francisco convention also rallied to the support of the Bureau, thus giving hope for cooperative relations between these two agencies of the mining industry.

• Director Finch has announced no policies or plans, but instead has been visiting organizations of mining men and field stations to familiarize himself with conditions in the industry and needs of the Bureau. We may venture to guess, however, that the new régime will give considerable attention to the economic aspects of the mineral industries. In particular we look for close cooperation between the Bureau and the Planning Committee for Mineral Policy, of which Secretary Ickes is chairman, in an effort to bring about an orderly development of our mineral industries and correlate production, stocks, and current consumption of mineral products.

• Evidence of a trend toward a healthier status in the non-ferrous metal industries is seen in the more effective control of production that has been exercised recently, particularly on the part of the larger companies. Serious effort is being made to keep metal production closely in line with consumptive requirements, showing realization on the part of the industry as a whole that only by such action can it participate most satisfactorily in the improvement in general business that is apparently now under way.

• Especially significant is the action of the United States Copper Association in the face of a recent decline in demand for new copper. Apparently for the first month since the code was adopted, September sales were not adequate to take care of the quotas; and rather than run the risk of rendering the sales plan of the code inoperative, the primary producers suspended sales allocations for the period from September 15 to October 31. During that time all sales are to be allocated to secondary, custom, and byproduct copper, and only when these quotas are filled will sales be allocated to primary producers. Incidentally, the Copper Association publicly affirmed its faith in the code as "essential to the orderly conduct of the industry," which is a gratifying expression in view of the prolonged opposition to the marketing provisions of the code prior to its acceptance. Evidently, some of the policies of NRA relating to control and regulation are fundamentally sound, particularly in their application to the natural-resource industries where it is feasible to correlate production closely with stocks and consumption.

The Mining Industry Takes Stock

HOWARD I. YOUNG
President of the American Mining Congress

OUR MINING INDUSTRY is dependent upon a general recovery of all industry, because our products are used largely in the manufacture of durable goods and in the construction industry. Unfortunately these fields of activity have lagged far behind in recovery, and until they show signs of revival the metal-mining industry will be faced with curtailed production and unemployment.

● Facing its problems in a realistic manner and taking an optimistic view of the future, the metal-mining industry of the United States brought to a close in San Francisco on Sept. 29 one of the most successful conventions ever held under the auspices of the Western Division of the American Mining Congress. The industry took stock of its recovery problems, rallied to the support of the Bureau of Mines, and adopted a platform of national policies.

● Some of these policies, in the opinion of the mining industry, are retarding instead of aiding general recovery. Restrictions on the investment of capital, uncertainty as to the future monetary policy of the Government, increasing Federal expenditures, the threat of heavy taxation, the entry of the Government into the field of private enterprise, and an unsettled labor policy are all factors in delaying a return to national prosperity. The mining industry is in sympathy with legislation and administration designed to curb vicious business practices and establish sound economic conditions, but it is also realistic enough to see that the pendulum may swing too far in the direction of reform.

● The vital importance of a sound labor policy leads the industry to state its belief that labor is entitled to the highest wage that can be paid, but that wage levels cannot be arbitrarily set by legislation or government fiat. Wages are paid from income, and income is not created by law but only through production of goods. The principle of collective bargaining by representatives of labor's own selection is sound, but we must condemn a policy that constitutes any labor organization the sole representative of all those employed within an industry. Proportionate representation of labor in any industry should be recognized, and even the right of the individual to bargain by means of his own choice should not be abridged. Finally, coercion is intolerable on the part of management, organized labor, or any other agency that interferes with the right of men employed in the mining industry to join or refuse to join any labor organization.

● Realizing its dependence on the stability of government and the general recovery of all lines of business, the mining industry has endeavored to contribute its best thought, not only to its own immediate problems but to those affecting the general welfare.

Mediation Effects Settlement of Major

MEDIATION, under the direction of two representatives of the Federal Government, proved effective on Sept. 17 in settling the strike called on May 8 at Butte, Mont., by workers of the Anaconda Copper Mining Company. Although not the first labor dispute to arise in the metal-mining industry since the inception of NRA, nor the first to be settled by mediation, it is the outstanding development of that character because of the number of workers involved, and owing to the direct bearing and influence that it had during its course on the various branches of the metal-mining industry.

The text follows of the agreement on which miners at Butte, Mont., cast a favorable vote on Sept. 17. Agreements favorably voted on by hoisting engineers and mill and smelter workers on the same date were similar, differing only in their application to those forms of employment.

Articles of Agreement, entered into between Anaconda Copper Mining Company, a corporation of the State of Montana (hereinafter called the Company), and Butte Miners' Union No. 1, of the International Union of Mine, Mill and Smelter Workers (hereinafter called the Union), covering rates of wages, hours of labor and other conditions of all miners employed in and about the mines of the Company in and about Butte, Montana.

Whereas the Company has recognized the jurisdiction of said Union over the miners as herein defined; and,

Whereas, the parties to this agreement desire to promote the spirit of harmony and cooperation between the Company and the employees subject to this agreement, members of said Union, the following agreement is entered into:

1. This agreement becomes effective on the seventeenth day of September, 1934, and continues for the period of one year, when it automatically renews itself and continues in full force and effect from year to year thereafter, unless notice is given by either party to the agreement not less than 90 days prior to the seventeenth day of September in any year that changes are desired in any or all of the provisions of this agreement.

2. The word "miner," as used herein, shall mean all underground workmen engaged in breaking ground, shoveling, timbering, tramming, repair work, and all such other underground work as may be connected herewith; also station tenders, topmen, surface laborers, including those working at the precipitating plants, change house men, sawyers and sawyers' helpers and clock-winding watchmen, but does not include any other watchmen.

3. It is the intention hereof, and it is hereby agreed, that the Union shall have full recognition, and may take into its organization all miners employed by the Company in any of the mines in the Butte district.

4. The Company agrees to retain in its employ, upon the conditions provided herein, only members of said Union in good standing, and that it will, within one week after the end of each calendar month, furnish to the Union a complete list, by mines, of all miners as herein defined, employed by it at its mines, during the preceding calendar month.

R. C. Jacobson, Federal mediator

The Union may, as soon thereafter as it shall determine, notify the Company of any such employees who were not members of said Union in good standing at the close of said month. The Company agrees to promptly notify each of such employees so designated, then in its employ, of such delinquency, and, if such employee or employees do not, within ten days after the service of such notice by the Union, place themselves in good standing, the Union will notify the Company of such fact, and such employees as do not comply with such requirements shall not be permitted to further continue in Company's employ during such delinquency.

5. It is further understood and agreed that the Company does not undertake, and shall not be asked, to settle or decide any question of jurisdiction as between the Union and any other whose members are employed by Anaconda.

6. During the life of this agreement the Union agrees that there shall be no collective cessation of work by the members of the Union on account of any controversy with the Company respecting the provisions of this agreement, or any controversy that may arise between the parties to this agreement, until and unless all of the means of settling any such controversy under the provisions of this agreement, or otherwise, shall have failed. The Company agrees that it will not lock out the employees covered by this agreement on account of any controversy with the employees respecting the provisions of this agreement, or any other controversy that may arise between the parties to this agreement, until and unless all other means of settling such controversy under the provisions of this agreement, or otherwise, shall have failed. Provided, however, that nothing in this agreement shall be interpreted as interfering in any way with the Company's right to extend, limit or curtail its operations, or to shut down completely when, in its sole discretion, it may deem it advisable so to do. Whenever feasible reasonable notice of any shutdown shall be given to the Union.

It is further agreed that should any condition lead to a stoppage of production, the Union will, at the request of the Company, keep such members of the Union as the Company may require engaged on such work on the properties of the Company in connection with the operation of pumps and other machinery, or on such other work as may be necessary to protect the properties from damage or destruction; it being understood that no such employees shall be required to work during the period of any strike if and when the Company attempts to produce.

7. It is mutually agreed that the following scale of wages and hours of labor shall apply to all workmen covered:

The minimum wage for underground miners for an eight-hour day shall be $4.25; provided that where differentials in amounts of rates of pay for miners, surface employees and other members of the Union covered by this agreement, because of classification, were, prior to the strike, higher or lower than said minimum, the differentials shall not be changed in amount. The said minimums are based upon a price for electrolytic copper of less than nine cents (9c.) per pound.

When the price of electrolytic copper is or exceeds nine cents (9c.) per pound and continues for a period of 30 successive days at or exceeding an average of nine cents (9c.) per pound, the said minimums shall be increased fifty cents (50c.) per day; when the price of electrolytic copper exceeds eleven and one-half cents (11½c.) per pound and continues for a period of 30 successive days at or exceeding an average of eleven and one-half cents (11½c.) per pound, there shall be a further increase in said wage of twenty-five cents (25c.) per day; and when the price of electrolytic copper exceeds thirteen cents (13c.) per pound and continues for a period of 30 successive days at or exceeding an average of thirteen

Labor Dispute in the Mining Industry

cents (13c.) per pound, there shall be a further increase in said wage of twenty-five cents (25c.) per day, and similar increases of twenty-five cents (25c.) per day shall be made for each one and one-half cents (1½c.) of rise in the average price of electrolytic copper for any period of 30 successive days above thirteen cents (13c.) subject to the conditions hereinafter provided.

There shall be no increase in the said wage until and unless the price for electrolytic copper reaches a base price at which an increase in the then current wage is to be made under the foregoing schedule and until and unless the average price of electrolytic copper for a period of 30 successive days thereafter equals or exceeds such base price, and in such event such changes shall remain in effect for a continuous period of not less than 30 successive days. In case the price of electrolytic copper declines below the base price upon which the then current wages are based and the average price of electrolytic copper for any period of 30 successive days thereafter is less than such base price, the wage to be paid after said 30-day period shall be the minimum wage above set forth plus such addition, if any, to such minimum wage, as the schedule above set forth provides shall be made with respect to such average price. Further successive increases or decreases in wages shall be made subject to the foregoing conditions, dependent upon the average price of copper from time to time; provided, however, that when a change in wage is made, no further change therein shall be made for at least 30 successive days.

The price for electrolytic copper on any day shall be that quoted for such day in the *Engineering and Mining Journal* for deliveries f. o. b. Connecticut Valley points, and the average price per pound of electrolytic copper for a period of 30 successive days shall be the average of the price for said 30 days set forth in said *Journal* for said deliveries.

Provided, however, that it is understood that the increase of fifty cents (50c.) per day for all classifications covered herein shall be maintained for a period of six months from the date of this agreement, regardless of whether or not the price of copper falls below nine cents (9c.) during such period.

Provided further that, if the price for electrolytic copper does not fall below nine cents (9c.) per pound during the period of six months from the date of this agreement, it is understood and agreed that the increase of fifty cents (50c.) per day for all classifications covered herein shall be maintained for a further period of six months, regardless of whether or not the price of copper falls below nine cents (9c.) per pound during such six months' period.

8. Overtime shall be paid for at the rate of time and one-half, and when employees are called out for work between the regular shifts they shall receive time and one-half for such service, and the minimum pay for service in such instances shall be not less than four hours of straight time.

The following named holidays shall be paid for at the rate of double time:

Memorial Day, July Fourth, Labor Day and Christmas.

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Philip W. Chappell, Federal mediator

9. Grievances:

(a) Any grievance or misunderstanding concerning any rule, practice or working condition, including the contract system, or any other grievance which cannot be settled on the job between any employee and his employer, must be first taken up with the management by said employee or his representative or representatives of his own choosing, and, in case a settlement cannot be made, the subject matter which caused the grievance must be taken up with a committee representing the Union and a committee of the Company.

In case of disagreement as to any facts existing on the ground, the Union committee or its representatives may, with a representative of the Company, make any necessary examinations at the working place involved.

(b) Any such grievance or misunderstanding which shall not have been settled as hereinabove provided shall be referred to a local industrial relations committee, to be organized at Butte as a result of this agreement, consisting of five members representing Butte Miners' Union No. 1, and five representatives of the Company. The Union members of the committee shall be selected by the Union from its members in such manner as shall be determined by the Union, and the representatives of the Company from its officers or employees, as shall be determined by it. This local industrial relations committee shall endeavor to effect an adjustment of the questions presented to it by either the Union or the Company. The vote of seven members of such local industrial relations committee shall be required to decide any question submitted. Should the committee fail to reach an adjustment of the question or questions presented to it within a period of fifteen days after the presentation thereof, or such further time as the committee shall mutually agree upon, the question or questions upon which no agreement has been reached shall be immediately submitted to an executive industrial relations committee as follows:

(c) The executive industrial relations committee shall be established, which shall consist of three members representing the employees and three members representing the employer. The representatives of the employees shall be selected one from Butte, one from Anaconda and one from Great Falls. Butte Miners' Union No. 1 and/or Butte Hoisting Engineers' Union No. 83 shall select the Butte member, as these unions shall determine; Anaconda Mill and Smeltermen's Union No. 117, of Anaconda, shall select the Anaconda member, and the Great Falls Mill and Smeltermen's Union No. 16 shall select the Great Falls member of said committee, such members to be selected from the membership of the unions in such manner as the unions entitled to make such selections shall determine. The representatives of the employer shall consist of one member from Butte, one from Anaconda and one from Great Falls, to be selected by the employer from among its officers or employees. The vote of four members of such executive industrial relations committee shall be required to decide any question submitted. Said committee shall reach a decision on the question or questions submitted within 30 days after the presentation thereof, or within such further time as the committee shall mutually agree upon. The decision of this executive industrial relations committee shall be final and binding upon the parties hereto. Said executive industrial relations committee shall meet at Butte or such other place or places as it may determine.

(d) It is understood and agreed that on any question or grievance arising between the Company and the Union which cannot be settled under the provisions of this agreement, and is submitted by the Union to a vote of its members, only those members of the Union involved in and directly affected by the issue in question shall have the right to vote thereon.

Fast Driving
In the Peruvian Andes

Record Speed in Mahr Tunnel Attained by Cerro de Pasco After Changing Drilling and Mucking Practice—Rapid Switching a Feature—A Bonus Also Helped

J. F. Foran
Superintendent

A. D. Bryant
Geologist and Chief Engineer

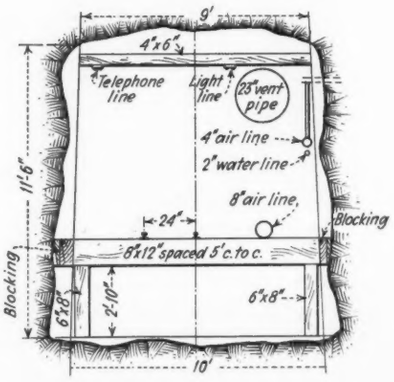
W. F. Walker
Engineer

Cerro de Pasco Copper Corporation
Lima, Peru

DECISION to drive a drainage tunnel to tap the water in the Morococha mines, in Peru, at approximately 700 ft. below the 1,000-ft. level was made in the latter part of 1928 by the Cerro de Pasco Copper Corporation, upon the recommendation of Harold Kingsmill, general manager. At this time, 16,000 gal. was being pumped per minute from the level mentioned against a 500-ft. head. The portal of this tunnel was located in due course at Mahr, a site on the Central Railway of Peru, 186 km. from Lima, at an elevation of 13,108 ft. above sea level. A grade of 0.25 per cent was selected for the tunnel, which was designed to take care of 30,000 g.p.m. of water, the maximum expected. The cross-section approved was 10 ft. wide at the bottom, 9 ft. wide at the top, and 12 ft. high. A high line to carry the tracks 2 ft. 10 in. above subgrade was included in the plans.

Work was started on the tunnel in March, 1929, with a staff consisting of a superintendent, an engineer, a master mechanic, tunnel foreman, and three shift bosses. The native personnel numbered 190 to 240 men. By April 30, 1934, the face had reached a point beneath the Natividad shaft 30,564 ft. from the portal, and work was suspended until connection with the shaft could be made. (*E.&M.J.*, May, 1934, p. 217.)

The most notable feature of this undertaking was the acceleration of operations during the last year of driving.



Cross-section of the Mahr tunnel

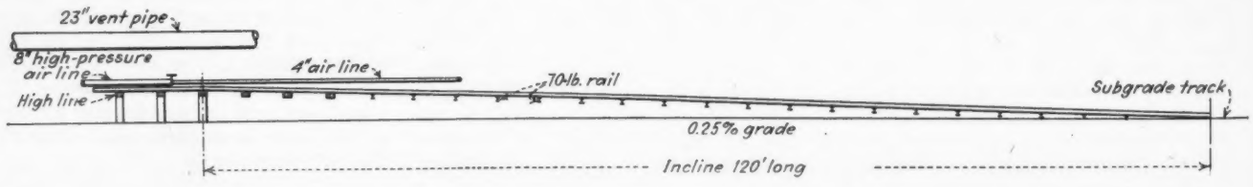
In the last four months of this period, the monthly advance was 978 ft., a remarkable record considering the conditions under which the work was done. Some of the changes made in the equipment and the methods used, to which the improvement is ascribable, should be of interest to other operators who are engaged in mining and tunneling.

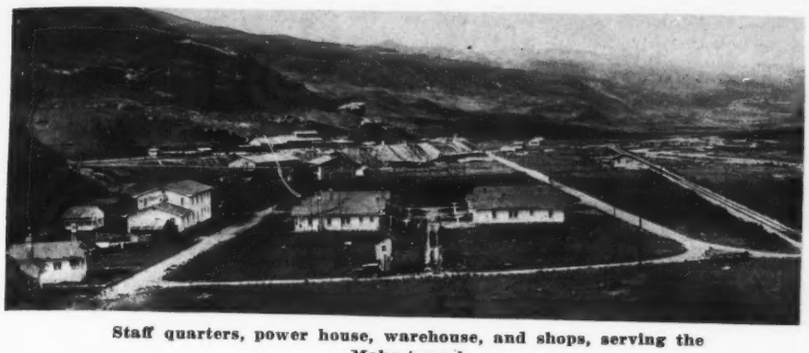
On April 19, 1933, a flow of water of approximately 32,000 g.p.m. was encountered when the face was 23,183 ft. from the portal. This quantity, in addition to the 18,000 g.p.m. already in the tunnel at that time, made a total of 50,000 g.p.m. flowing through the tunnel. Water rose above the high line, 22 in. above subgrade, and completely paralyzed operations until the middle of July of that year. By July 16, the water had subsided sufficiently to enable work to be resumed at the face.

Up to the time of the flood in April, a portable drill carriage, carrying four mounted Ingersoll-Rand S-70 machines, was used. The carriage was moved by an electric locomotive back and forth from a storage crosscut, which never was more than 1,400 ft. back from the face. Delays due to derailments of the carriage on the submerged subgrade tracks, and difficulty in laying portable track sections to the face, led to the adoption of the practice of using two horizontal bars set up at the face. By this means we were able to use six machines, three on each bar, thus reducing the over-all drilling time. With the drill carriage, working on a practically dry subgrade, the average time consumed from the end of mucking to the start of drilling was 25 min. With the bars and platform the average time required for the six machines was 30 min. The water was only a slight hindrance. Over-all drilling time was reduced from 2 hr. to 45 min. with the drill carriage to 2 hr. with the bars.

During the first 16,000 ft. of driving a diamond cut was used, with a total of 34 holes in the round. This procedure was then changed to a 6-hole V cut with a total of 26 holes. The depth of the round drilled, moreover, was increased from 9 to 11 ft., which netted a 9.8-ft. break against a previous

Incline from subgrade to the high line





Staff quarters, power house, warehouse, and shops, serving the Mahr tunnel

break of 7.8 ft. Further improvement was made by rebuilding the drills. After almost five years of constant use the efficiency of the S-70 machines had lowered considerably. Wonderful improvement was made in drilling time after the six machines had been equipped with new cylinders, rifle bars, and pistons. The 26 11-ft. holes frequently were drilled in 1 hr. 25 min. The steel used was $1\frac{1}{4}$ in., hollow round, made up in 3-ft. to 13-ft. lengths, with 2-ft. changes, and gaged from $2\frac{1}{4}$ in. on starters to $1\frac{5}{8}$ in. on the 13-ft. lengths. All sharpening was done on two Ingersoll-Rand No. 50 machines.

Du Pont Special 50 per cent gelatin, in $1\frac{1}{2}$x8-in. sticks, was used. A 24-hr. supply was always kept in a small powder magazine about 2,000 to 5,000 ft. back from the face. The main magazine and make-up house was built outside the tunnel, several hundred yards from the portal. Powder consumption varied from 6.2 to 9.8 lb. per cubic yard, calculated on the theoretical cross-section of 4.22 cu.yd. per linear foot of tunnel. The detonators used were Atlas and Hercules No. 8 electric delays. They were fired from a 440-volt a.c. line. Nine delays were used, three of which were in the six cuts. In the diamond cut all four holes in each of the double cuts were fired simultaneously, causing excessive fly-rock. By using No. 1 delay caps in the center V cuts, No. 2 on the right and No. 3 on the left side, practically all of the fly-rock was kept within 80 ft. of the face. This feature in the blasting operations aided in making a fast set-up with the scraper slide. The detonator was placed in the second cartridge from the bottom, and two cartridges of stemming were used in each hole. Loading, wiring, and firing were done by each shift under the supervision of the shift boss and shift electrician.

Loading during the first 17,000 ft. of driving was handled by mechanical loaders, but, due to depreciation through long use and to high upkeep cost when working with the moving parts submerged in dirty water, it was found advantageous to replace the loaders by a scraper slide made in the shops of the Corporation at La Oroya. The slide was equipped with a Sullivan 35-hp. double-drum electric hoist. The scraper was a 52-in. hoe type with heavy manganese teeth. Two 12-in. Sullivan snatch blocks were placed at the face instead of one block, as is customary. In using the two snatch blocks, one on either side was attached to a Lewis wedge in the second rib hole below the back, and the scraper was swung from side to side simply by opening one snatch block and reversing the tail rope. This practice required a minimum amount of shoveling along the sides for clean-up. The two rib holes mentioned were drilled 2 ft. deeper than the remainder of the round, and the lower 2 ft. tamped with dummies. This procedure left clean holes for the Lewis wedges.

The scraper slide was made with a

Portal of Mahr tunnel, seen from above. The black line indicates the direction of the tunnel

1-in. taper from the entrance throat to the discharge opening, a feature which eliminated the wedging of the scraper caused by entrance of pieces of rock between the scraper and the slide. The slide was stored on a siding never more than 1,200 ft. from the face. After blasting it was usually set up and made ready to operate in 25 to 40 min.

Switching was done on a 3-track, 4-rail system, the head switch being moved forward when the scraper slide set-up was three rail lengths, or 90 ft., from the switch points. Empty cars were pushed forward by motor to the switch on the right-hand track; then, as another motor pulled the load away from the scraper onto the left-hand track, two men moved the empty car onto the single loading track, and the motor would spot the car for loading.

Switching and loading operations were very fast; frequently as many as 36 50-cu.ft. cars were loaded in one hour. The movement of switches, which seldom caused a delay in routine work, was always made on the day shift while drilling was in progress.

Side-dump Koppel cars of 50-cu.ft. capacity were employed with satisfaction throughout the driving of the tunnel. Trains were made up of twelve cars and were hauled by 6-ton General Electric locomotives. Storage crosscuts, driven at 5,000-ft. intervals, were double-tracked and of sufficient length to accommodate 24 cars and a locomotive. All transportation was controlled by a block system, each motorman throwing his own signal light.

During the last year of work the high line was under 12 to 16 in. of water 60 per cent of the time for a distance of 15,000 ft., a factor which reduced running speed of trains to 50 per cent of normal. The performance of the locomotives in water was remarkable, operating as they did for several weeks before an armature failed.

During the last seven months of operation, flows of water of 5,000 to 8,000 g.p.m. were encountered on four occasions, none of them causing delays of more than a few shifts.

Raising the track from subgrade to high line was developed to a point where it was possible to place 180 8x12-in. caps at 5-ft. centers on supporting posts, block them in, lift the track from subgrade and spike it to the caps, and move the incline 900 ft. ahead in five hours. This was done without delay in driving operations at the face

Ventilation air was supplied to the face through a 16-gage, electric-welded pipe, 23 in. in diameter, made up into 30- to 64-ft. flanged sections. The pipe was placed in the upper right corner of the tunnel close to the back, and up to within 80 to 140 ft. of the face. Throughout driving of the tunnel it was possible for men to return to the face within 10 min. after blasting. Releasing of high-pressure air close to the face after blasting was an important factor in making possible rapid resumption of operations at the face. Air for ventilation throughout the length of the tunnel was supplied by a single Connersville blower with a displacement of 10,200 cu.ft. of free air per minute. Upon completion of the tunnel the blower was supplying ventilating air to the face over a distance of 30,564 ft. with a discharge pressure at the blower of 3 lb. per square inch. The high-pressure air was supplied by two PRE No. 2 Ingersoll-Rand compressors, each with a displacement of 2,200 cu.ft. of free air per minute. The air was carried by an 8-in. Dayton coupling line to within 1,000 ft. of the face. From that point a 4-in. diameter line was used. Pressure at the compressors ordinarily was maintained at 100 lb. per square inch, but it was raised to 110 lb. during the drilling period.

The following advance for the first four months of 1934 was made: January, 910 ft.; February, 912 ft.; March, 1,110 ft.; and April, 981 ft.

The time for an average cycle during those months was as follows:

Drilling	2 hr.	00 min.
Loading and blasting		25 min.
Ventilating		10 min.
Setting up scraper		25 min.
Scraper loading	2 hr.	00 min.
Setting up bars and machines		30 min.
Delays (mostly waiting for empty cars from the storage crosscuts, and derailments)		30 min.
Total cycle	6 hr.	00 min.

One serious cause of delays which never was completely eliminated was the number of derailments on the subgrade, due to heavy flows of water which washed rocks onto the tracks at some places, and washed ballast out from under the tracks at others.

Labor efficiency was kept at a high level by the stimulus of a bonus system and by maintaining equipment in first-class condition. These two items accounted largely for the excellent showing made in the presence of difficult working conditions such as enormous waterspouts in the tunnel and high altitude.

The rock through which the tunnel was driven is almost entirely of volcanic origin. Called locally the Catalina volcanics, the formation is of Carboniferous age and consists of breccias, tuffs, and flows, which vary from rhyolite to andesite. The rock is fairly hard but in places blocky.

The underlying Silurian shale, locally called the Excelsior shale, was encountered for 1,200 ft., having been brought up to the elevation of the tunnel by faulting. This formation is a soft, black rock which necessitated timbering. The last 1,000 ft. of the tunnel is in the Morococha intrusive, a hard monzonite.

An old river bed, which was cut about 2,000 ft. from the portal, was 900 ft. wide and carried a large amount of water. The material in this bed consists of clay and gravel.

A large number of faults, some of which are mineralized, were encountered. These fractures vary in width from a few inches to 15 ft. and carried from a few hundred to 32,000 g.p.m. of water.

[According to the management, the following men were largely responsible for the remarkable record made in driving the Mahr tunnel after the Corporation started work upon it: J. F. Foran, superintendent; W. F. Walker, geologist and chief engineer; C. S. T. Farish, general foreman; A. D. Bryant, engineer; J. T. Glidden, shift boss; B. P. Grueneich, shift boss; A. Nycander, shift boss; and A. E. Sex, shift boss, and, later, superintendent.—EDITOR.]

The day shift (8 a.m. to 4 p.m.) at the portal of the Mahr tunnel

What Will It Cost To Work a Gold Placer of Medium Size?

Harry C. Chellson

Vice-President, Prommel Mining Company, 823 Plymouth Ave., Schenectady, N. Y.

MANY PLACER AREAS which have been inspected to determine their merits as gold-dredging enterprises have been classified as too small for large-scale operations. In many instances they probably would have shown a profit when gold was $20.67 an ounce, but the physical conditions of the areas limited successful operation by means of large dredges. Capital could not be interested in them inasmuch as no successful mechanical means had been devised to meet the physical conditions so as to warrant profitable exploitation. They therefore have remained practically virgin down to the present time, or have been worked in a desultory way by the placer miner with his pick, shovel, sluice box, and gold pan. Small operations have been carried on by mechanical means, the success of which depended upon the ingenuity of the individual.

Some have clung to the idea that these medium-sized gold placers could be operated successfully on a large scale. In Bulletin 259, of the United States Bureau of Mines, by Norman L. Wimmler, mention is made of the placer operation carried on by means of a drag-line shovel and small dredge. Until recently, however, economic conditions have not favored further investigation in this field. The demand for gold since 1931, together with the lack of employment suffered by experienced mining engineers, created the opportunity for seeking ways to determine successful methods of operating and exploiting medium-sized placers. Such research has never been so extensive as during the past three years. One may say that this development is a new phase of gold mining. It has received even greater attention since the value of gold rose to $35 an ounce. However, reliable information and data seem to be lacking as to the operating costs of such placers as have had any measure of success in their various runs.

Three tables are presented with this article which embody the operating costs determined on various test runs on a medium-sized gold placer area of 76 acres that is being worked by the Prommel Mining Company, of Denver. The physical conditions of the property were favorable. It is situated only 40 miles northwest of Denver, on South Boulder Creek, in Gilpin County. It can be reached by automobile over Colorado Scenic Highway No. 70. The Denver & Salt Lake Railroad (Moffat Road) flanks its whole length, so that it was possible to unload freight directly at the site of the first operations. Abundant water is available, and the gravel is loose and easily worked. Vegetation is sparce. The valley has an average width of 400 ft. and a gentle grade of 1½ per cent. Remains of a large pit left after hydraulicking in 1894-96 made a convenient place for starting work and disposing of tailings. These conditions combined with the application of engineering principles by H. W. C. Prommel, president and general manager, made it possible to accomplish much work and to gather valuable information on this phase of mining.

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Calculations based on the operation of a property in Gilpin County, Colorado, are presented by the author in the accompanying tables

Figures are given for 24-hour yardages of 100 up to 2,000; for gravel ranging in value from 20c. up to 74c. per yard; and for a price of both $20.67 and $35 per ounce

◆

The equipment used consisted of a dry land dredge manufactured by Morse Brothers, of Denver, and a Lima 1¼-cu.yd. drag-line shovel. The dredge was moved on six pairs of mine-car trucks over 20-lb. rails. Some test runs were made in December, 1932, under difficult weather conditions, and other runs were made in the summer of 1933. Experience soon showed that as long as the dredge was set in a convenient location for digging and for tailings disposal, operations could be successfully maintained. When it had to be moved to the next location, too much time was consumed in the necessary preparations. This loss of time will be eliminated, and the efficiency of the work improved, if the dredge is placed on pontoons and floated.

The data given in the accompanying tables may serve as a guide, in a general way, for the contemplated operation of a placer of medium size.

Table I shows the cost per cubic yard for a yardage ranging from 100 to 2,000 per day.

Table II shows the cost per cubic yard, inclusive of a 10 per cent royalty, for gravel ranging in gold content from 20c. to 74c. per cubic yard. The value of the gravel may be computed with gold at either $20.67 an ounce or $35 per ounce.

Table III shows the approximate net profit to be derived from operations, for gravels of respective values falling within the stated range.

Table I—In studying this table the item of labor is determined by having one man near the dredge hopper to watch the feed delivered to the trommel. One man tends the motors and pumps, and a third oversees the sluice boxes, tailings disposal, and stacker belt. One utility man is available for general work. Wages of $3 per day are in conformance with the contemplated Colorado Code of Fair Competition for the Precious Metal Industry, inasmuch as that was the surface wage rate in effect in September, 1933.

Table I—Itemized Operating Cost per Cubic Yard

Item	Cubic Yards per 24-Hours, Three 8-Hour Shifts																			
	100	200	300	400	500	600	700	800	900	1,000	1,100	1,200	1,300	1,400	1,500	1,600	1,700	1,800	1,900	2,000
Labor	0.300	0.150	0.100	0.075	0.060	0.050	0.043	0.037	0.033	0.030	0.027	0.025	0.023	0.021	0.020	0.019	0.018	0.017	0.016	0.015
Shovel operators	0.240	0.120	0.080	0.060	0.048	0.040	0.034	0.030	0.026	0.024	0.022	0.020	0.018	0.017	0.016	0.015	0.014	0.013	0.013	0.012
Manager	0.082	0.041	0.027	0.020	0.016	0.014	0.011	0.010	0.009	0.008	0.007	0.007	0.006	0.006	0.006	0.005	0.005	0.004	0.004	0.004
Superintendent	0.065	0.032	0.022	0.016	0.013	0.011	0.009	0.008	0.007	0.006	0.006	0.005	0.005	0.005	0.005	0.004	0.004	0.003	0.003	0.003
Shovel gas and oil	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
Shovel maintenance	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
Motors, gas and oil	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
Dredge maintenance	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
Compensation	0.023	0.011	0.008	0.006	0.004	0.004	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001
Depreciation	0.156	0.078	0.052	0.039	0.031	0.026	0.022	0.019	0.017	0.016	0.014	0.013	0.012	0.011	0.010	0.010	0.009	0.009	0.008	0.008
Royalty	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Shutdown time	0.156	0.078	0.052	0.039	0.031	0.026	0.022	0.019	0.017	0.016	0.014	0.013	0.012	0.011	0.010	0.010	0.009	0.009	0.008	0.008
Total cost per cubic yard	0.976	0.564	0.395	0.309	0.257	0.225	0.198	0.180	0.166	0.156	0.146	0.139	0.132	0.127	0.122	0.118	0.114	0.110	0.107	0.105

Data on Which Tables I, II, and III Are Based

10 men at $3 per day .....$30.00 per day
3 shovel operators at $1 per hour—24 hours .....$24.00 per day
1 general manager at $250 per month .....$ 8.20 per day
1 superintendent at $200 .....$ 6.55 per day
50 cu.yd. per hour, shovel uses 6 gal. of gasoline per hour at 12½c. per gal.—20 hr., $15. Oil, $1.35. Total per hour, $0.817
Cables, dipper teeth, bands, approximately 1c. per yard.
2 Ford industrial engines, approximately.....$16.85 per day
Dredge maintenance, approximately .....1 cent per cubic yard
Colorado workman's compensation $3.43 per $100 of payroll or .....$2.36 per day
Depreciation—12½ per cent on approximately $25,000 worth of machinery and equipment, or $3,125 per year—200 working days .....$15.63 per day
Royalty charge—10 per cent of net Mint returns included in cost per cubic yard, Table II.
Shutdowns—5½ days per month approximately, or $71.11 per day distributed over working month, giving .....$15.60 per day

Table II—Approximate

Gravel Valued at 20 to 74 Cents per Cubic Yard.

Cubic Yards Per 24 Hour	0.20	0.34	0.21	0.355	0.22	0.373	0.23	0.39	0.24	0.405	0.25	0.425	0.26	0.44	0.27	0.455	0.28	0.475	0.29	0.49	0.30	0.51	0.31	0.525
100																								
200																								
300																		0.442		0.444		0.44		0.447
400						0.346		0.348		0.349		0.351		0.353		0.354		0.354		0.356		0.35		0.359
500		0.291		0.292		0.294		0.296		0.297		0.299		0.301		0.302		0.304		0.306	0.287	0.30	0.288	0.309
600		0.259		0.260		0.262		0.264		0.265		0.267	0.251	0.269	0.252	0.270	0.253	0.272	0.254	0.274	0.255	0.276	0.256	0.277
700		0.232		0.233		0.235		0.237	0.222	0.238	0.223	0.240	0.224	0.242	0.225	0.243	0.226	0.245	0.227	0.247	0.228	0.249	0.229	0.250
800		0.214		0.215		0.217	0.203	0.219	0.204	0.220	0.205	0.222	0.206	0.224	0.207	0.225	0.208	0.227	0.209	0.229	0.210	0.231	0.211	0.232
900		0.200		0.201	0.188	0.203	0.189	0.205	0.190	0.206	0.191	0.208	0.192	0.210	0.193	0.211	0.194	0.213	0.195	0.215	0.196	0.217	0.197	0.218
1,000	0.176	0.190	0.177	0.191	0.178	0.193	0.179	0.195	0.180	0.196	0.181	0.198	0.182	0.200	0.183	0.201	0.184	0.203	0.185	0.205	0.186	0.207	0.187	0.208
1,100	0.166	0.180	0.167	0.181	0.168	0.183	0.169	0.185	0.170	0.186	0.171	0.188	0.172	0.190	0.173	0.191	0.174	0.193	0.175	0.195	0.176	0.197	0.177	0.198
1,200	0.159	0.173	0.160	0.174	0.161	0.176	0.162	0.178	0.163	0.179	0.164	0.181	0.165	0.183	0.166	0.184	0.167	0.186	0.168	0.188	0.169	0.190	0.170	0.191
1,300	0.152	0.165	0.153	0.166	0.154	0.168	0.155	0.170	0.156	0.171	0.157	0.173	0.158	0.175	0.159	0.176	0.160	0.178	0.161	0.180	0.162	0.182	0.163	0.183
1,400	0.147	0.161	0.148	0.162	0.149	0.164	0.150	0.166	0.151	0.167	0.152	0.169	0.153	0.171	0.154	0.172	0.155	0.174	0.156	0.176	0.157	0.178	0.158	0.179
1,500	0.142	0.156	0.143	0.157	0.144	0.159	0.145	0.161	0.146	0.162	0.147	0.164	0.148	0.166	0.149	0.167	0.150	0.169	0.151	0.171	0.152	0.173	0.153	0.174
1,600	0.138	0.152	0.139	0.153	0.140	0.155	0.141	0.157	0.142	0.158	0.143	0.160	0.144	0.162	0.145	0.163	0.146	0.165	0.147	0.167	0.148	0.169	0.149	0.170
1,700	0.134	0.148	0.135	0.149	0.136	0.151	0.137	0.153	0.138	0.154	0.139	0.156	0.140	0.158	0.141	0.159	0.142	0.161	0.143	0.163	0.144	0.165	0.145	0.166
1,800	0.130	0.144	0.131	0.145	0.132	0.147	0.133	0.149	0.134	0.150	0.135	0.152	0.136	0.154	0.137	0.155	0.138	0.157	0.139	0.159	0.140	0.161	0.141	0.162
1,900	0.127	0.141	0.128	0.142	0.129	0.144	0.130	0.146	0.131	0.147	0.132	0.149	0.133	0.151	0.134	0.152	0.135	0.154	0.136	0.156	0.137	0.158	0.138	0.159
2,000	0.125	0.139	0.126	0.140	0.127	0.142	0.128	0.144	0.129	0.145	0.130	0.147	0.131	0.149	0.132	0.150	0.133	0.152	0.134	0.154	0.135	0.156	0.136	0.157

Table III—Approximate Net

Cubic Yards per 24 Hours	0.20	0.34	0.21	0.355	0.22	0.373	0.23	0.39	0.24	0.405	0.25	0.425	0.26	0.44	0.27	0.455	0.28	0.475	0.29	0.49	0.30	0.51
100																						
200																						
300																		9.90		13.80		19.20
400						10.80		16.80		22.40		30.00		36.00		41.20		48.40		53.60		60.80
500		24.50		31.50		39.50		47.00		54.00		63.00		69.50		76.50		85.50		92.00	6.50	101.00
600		48.60		57.00		66.60		75.60		84.00		84.80		102.60	10.89	111.00	16.20	121.80	21.60	129.00	27.00	140.40
700		75.60		85.40		96.60		107.10	12.60	116.90	18.90	129.50	25.20	138.60	31.50	148.40	37.80	161.00	44.10	170.10	50.40	182.70
800		100.80		112.00		124.80	21.60	136.80	28.80	148.00	36.00	162.40	42.30	172.80	50.40	184.00	57.60	198.40	64.80	208.80	72.00	223.20
900		126.00		138.60	28.80	153.00	36.90	166.50	45.00	179.10	53.10	195.30	61.20	207.00	69.30	219.60	77.40	238.50	85.50	247.50	93.60	263.70
1,000	24.00	150.00	33.00	164.00	42.00	180.00	51.00	195.00	60.00	209.10	69.00	227.00	78.00	240.00	87.00	254.00	96.00	272.00	105.00	285.00	114.00	303.00
1,100	37.50	176.00	47.30	191.40	57.20	209.00	67.10	225.50	77.00	240.90	86.90	260.70	96.80	275.00	106.70	290.40	116.60	310.00	126.50	324.50	136.40	344.30
1,200	49.20	200.40	60.00	217.20	70.80	236.40	81.60	254.40	92.40	271.20	103.20	292.80	114.00	308.40	124.80	325.20	135.60	346.80	146.40	362.40	157.20	384.00
1,300	62.40	227.50	74.10	245.70	85.80	266.50	97.50	286.00	109.20	304.20	120.90	327.60	132.60	344.50	144.30	362.70	156.00	386.10	167.70	403.00	179.40	420.40
1,400	74.20	250.60	86.80	280.20	99.40	292.60	112.00	313.60	124.60	333.20	137.20	358.40	149.80	376.60	162.40	396.20	175.00	421.40	187.60	439.60	200.20	464.80
1,500	87.00	276.00	100.50	297.00	114.00	321.00	127.50	343.50	141.00	364.80	154.50	391.50	168.00	411.00	181.50	432.00	195.00	459.00	208.50	478.50	222.00	505.50
1,600	99.20	300.80	113.60	325.20	128.00	348.80	142.40	372.80	156.80	395.20	171.20	424.00	185.60	444.80	200.00	467.20	214.40	496.00	228.80	516.80	243.20	545.60
1,700	112.20	326.40	125.50	350.20	142.80	377.40	158.10	402.40	173.40	426.70	188.70	457.30	204.00	479.40	219.30	503.20	234.60	533.80	249.90	555.90	265.20	586.50
1,800	126.00	352.80	142.20	378.00	158.40	406.80	174.60	433.80	190.80	459.00	207.00	491.40	223.20	514.80	239.40	540.00	255.60	572.40	271.80	595.80	288.00	618.20
1,900	138.70	378.10	155.80	404.70	172.90	435.10	190.00	463.60	207.10	430.20	219.20	524.40	241.30	549.10	256.40	575.70	275.50	609.90	292.60	634.60	309.70	668.80
2,000	150.00	402.00	168.00	430.00	188.00	462.00	204.00	492.00	222.00	520.00	240.00	556.00	258.00	582.00	276.00	610.00	294.00	646.60	312.00	672.00	330.00	708.00

Three experienced shovel operators are employed and receive the standard wage of private operators in Colorado —namely, $1 per hour. One general manager at $250 per month and one superintendent at $200 are required.

The item of the cost of gasoline and oil for the shovel is estimated on the assumption that 50 cu.yd. is delivered per hour by the 1¼-cu.yd. Lima drag line to the dredge hopper, which was 8 ft. square and 17 ft. above the ground. This is based on a test run of 2,553 cu.yd., during which the operator would dig, spot the bucket over the hopper, and start another cycle. Without having to spot the bucket over the hopper the operator can dig 70.8 cu.yd. per hour, this having been determined when digging a drainage ditch 1,950 ft. long, from which 20,168 cu.yd. of gravel was removed. The rate of 50 cu.yd. per hour delivered to the hopper by an experienced man is a reliable guide to follow, therefore, in making an estimate for placer work with a 1¼-cu.yd. drag line. A 40-ft. boom was used.

Gasoline consumption was determined from all work done to be 6 gal. per hour. Consumption of oil is about 3½ gal. every 48 hr., 1 gal. being added every 8 hr. The oil must be of the best grade, that used costing 60c. a gallon. Grease consumption amounts to about 50c. per day. Calculated for 20 hr. of shovel operation, the cost of the gasoline consumed, at 12½c. per gallon, plus oil, was $16.35. On the basis of 50 cu.yd. per hour, the unit charge would be 0.01655c. per cubic yard. For practical purposes this is put down as 0.017c. per cubic yard on the chart. Inasmuch as this figure would practically cover the cost per cubic yard, if a 2½-cu.yd. shovel were to be used, it is taken for this item also if the rate of operation should be 100 cu.yd. per hour, or about 2,000 cu.yd. per day.

The item of shovel maintenance is determined by the fact that, for every 210 hr. of digging, two cables, costing about $48, are required. This is a charge of about 0.228c. per hour, or 0.005c. per cubic yard. In average ground a shovel requires a new set of dipper teeth every 70 hr. The cost per set is approximately $20. The corresponding charge is about 0.004c. per hour. Allowing for a larger shovel, therefore, this maintenance item could reasonably be placed at 0.01c. per cubic yard. This would also allow for such small items as drag and hoist bands.

Motive power on the dredge consisted of two Ford industrial engines. One is located underneath the hopper and drives a feeder belt running from the hopper to the trommel screen; also a double trommel screen 12 ft. long by 4 ft. in diameter; a 14-ft. discharge tailings belt; a pump handling 900 g.p.m.; and another pump of 200 g.p.m. It is also belted to a clutch pulley, which facilitates the pumping of water.

The other Ford engine drove a 125-ft.

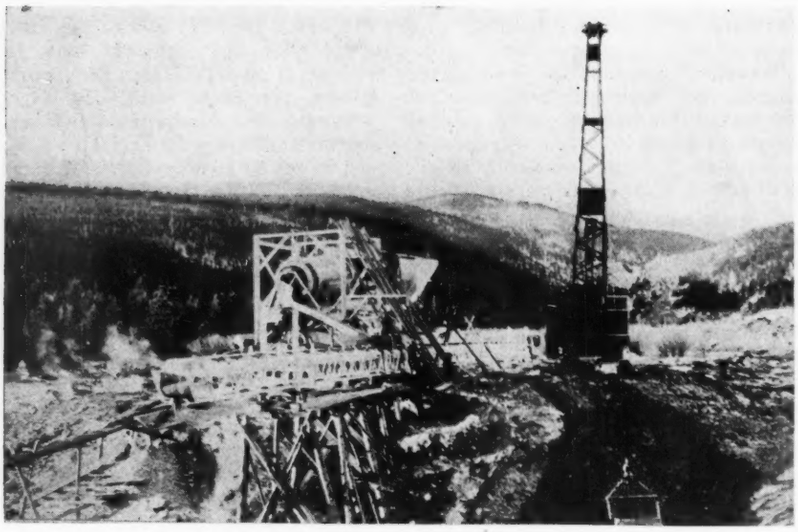
Cost per Cubic Yard

Gold Valued at $20.67 or $35 per Ounce

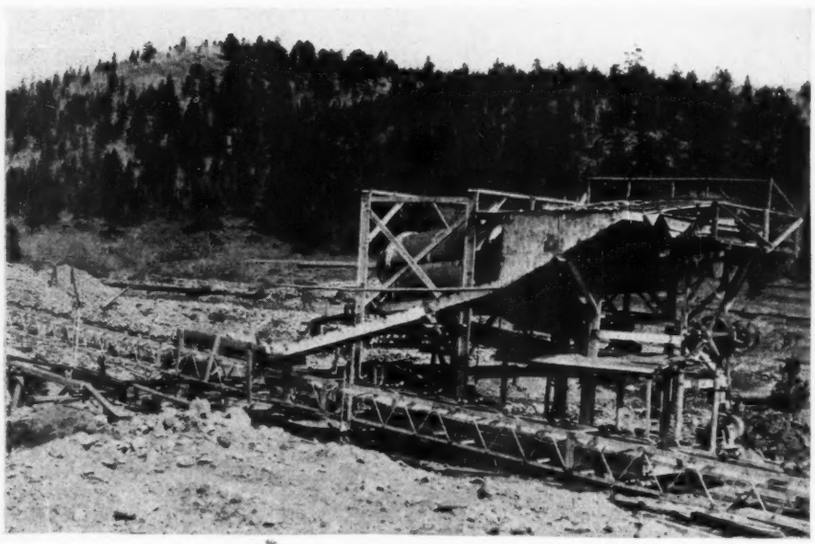
																										Cubic Yards Per 24 Hour
0.32	0.54	0.33	0.56	0.34	0.575	0.35	0.59	0.36	0.61	0.37	0.625	0.38	0.64	0.39	0.657	0.40	0.675	0.41	0.69	0.42	0.71	0.43	0.725	0.44	0.74	
																										100
																	0.631		0.633		0.635		0.637		0.639	200
0.447		0.449		0.451		0.452		0.454		0.456		0.457		0.459		0.461		0.463		0.465		0.467		0.469		0.471	300
0.359		0.361		0.363		0.364		0.366		0.368		0.369		0.371		0.373	0.349	0.375	0.350	0.377	0.351	0.379	0.352	0.381	0.353	0.383	400
0.309	0.289	0.311	0.290	0.313	0.291	0.314	0.292	0.316	0.293	0.318	0.294	0.319	0.295	0.321	0.296	0.323	0.297	0.325	0.298	0.327	0.299	0.329	0.300	0.331	0.301	0.333	500
0.277	0.257	0.279	0.258	0.281	0.259	0.282	0.260	0.284	0.261	0.286	0.262	0.287	0.263	0.289	0.264	0.291	0.265	0.293	0.266	0.295	0.267	0.297	0.268	0.299	0.269	0.301	600
0.250	0.230	0.252	0.231	0.254	0.232	0.255	0.233	0.257	0.234	0.259	0.235	0.260	0.236	0.262	0.237	0.264	0.238	0.266	0.239	0.268	0.240	0.270	0.241	0.272	0.242	0.274	700
0.232	0.212	0.234	0.213	0.236	0.214	0.237	0.215	0.239	0.216	0.241	0.217	0.242	0.218	0.244	0.219	0.246	0.220	0.248	0.221	0.250	0.222	0.252	0.223	0.254	0.224	0.256	800
0.218	0.198	0.220	0.199	0.222	0.200	0.223	0.201	0.225	0.202	0.227	0.203	0.228	0.204	0.230	0.205	0.232	0.206	0.234	0.207	0.236	0.208	0.238	0.209	0.240	0.210	0.242	900
0.208	0.188	0.210	0.189	0.212	0.190	0.213	0.191	0.215	0.192	0.217	0.193	0.218	0.194	0.220	0.195	0.222	0.196	0.224	0.197	0.226	0.198	0.228	0.199	0.230	0.200	0.232	1,000
0.198	0.178	0.200	0.179	0.202	0.180	0.203	0.181	0.205	0.182	0.207	0.183	0.208	0.184	0.210	0.185	0.212	0.186	0.214	0.187	0.216	0.188	0.218	0.189	0.220	0.190	0.222	1,100
0.191	0.171	0.193	0.172	0.195	0.173	0.196	0.174	0.198	0.175	0.200	0.176	0.201	0.177	0.203	0.178	0.205	0.179	0.207	0.180	0.209	0.181	0.211	0.182	0.213	0.183	0.215	1,200
0.183	0.164	0.185	0.165	0.187	0.166	0.188	0.167	0.190	0.168	0.192	0.169	0.193	0.170	0.195	0.171	0.197	0.172	0.199	0.173	0.201	0.174	0.203	0.175	0.205	0.176	0.207	1,300
0.179	0.159	0.181	0.160	0.183	0.161	0.184	0.162	0.186	0.163	0.188	0.164	0.189	0.165	0.191	0.166	0.193	0.167	0.195	0.168	0.197	0.169	0.199	0.170	0.201	0.171	0.203	1,400
0.174	0.154	0.176	0.155	0.178	0.156	0.179	0.157	0.181	0.158	0.183	0.159	0.184	0.160	0.186	0.161	0.188	0.162	0.190	0.163	0.192	0.164	0.194	0.165	0.196	0.166	0.198	1,500
0.170	0.150	0.172	0.151	0.174	0.152	0.175	0.153	0.177	0.154	0.179	0.155	0.180	0.156	0.182	0.157	0.184	0.158	0.186	0.159	0.188	0.160	0.190	0.161	0.192	0.162	0.194	1,600
0.166	0.146	0.168	0.147	0.170	0.148	0.171	0.149	0.173	0.150	0.175	0.151	0.176	0.152	0.178	0.153	0.180	0.154	0.182	0.155	0.184	0.156	0.186	0.157	0.188	0.158	0 190	1,700
0.162	0.142	0.164	0.143	0.166	0.144	0.167	0.145	0.169	0.146	0.171	0.147	0.172	0.148	0.174	0.149	0.176	0.150	0.178	0.151	0.180	0.152	0.182	0 153	0.184	0.154	I.186	1,800
0.159	0.139	0.161	0.140	0.163	0.141	0.164	0.142	0.166	0.143	0.168	0.144	0.169	0.145	0 171	0.146	0.173	0.147	0.175	0.148	0.177	0.149	0.179	0.150	0.181	0.151	0.183	1,900
0.157	0.137	0.159	0.138	0.161	0.139	0.162	0.140	0.164	0.141	0.166	0.142	0.167	0.143	0.169	0.144	0.171	0.145	0.173	0.146	0.175	0.147	0.177	0.148	0.179	0.149	0.181	2,000

Profit per Day to Be Derived

																										Cubic Yard per 24 Hour
0.31	0.525	0.32	0.54	0.33	0.56	0.34	0.575	0.35	0.59	0.36	0.61	0.37	0.625	0.38	0.64	0.39	0.657	0.40	0.675	0.41	0.69	0.42	0.71	0.43	0.725	0.44	0.74	
																												100
																			8.80		11.40		15.00		17.60		20.20	200
19.20		23.40		27.30		33.00		36.90		40.80		46.20		50.40		54.30		58.80	63.60		67.50		72.90		76.80		80.70	300
60.80		66.40		71.60		78.80		84.40		89.60		96.80		102.40		107.60		113.60	120.00		125.20		132.40		137.60		142.80	400
101.00	11.00	108.00	15.00	114.50	20.00	123.50		130.00		137.00		146.00		153.00		159.50		167.00	175.00		181.50		190.50		197.00		203.50	500
140.40	32.40	148.00	37.80	156.60	43.20	167.40		175.80		183.60		194.40		202.80		210.60		219.60	229.20		237.00		247.80		255.60		263.40	600
182.70	56.70	192.50	63.00	201.60	69.30	214.20		234.00		233.10		245.70		255.50		264.60		275.10	286.30		295.40		308.00		317.10		326.20	700
223.20	79.20	234.40	86.40	242.40	93.60	259.20		268.40		280.80		287.20		306.40		316.80		328.80	341.60		352.00		366.40		376.80		387.20	800
263.70	101.70	276.30	109.80	288.00	117.90	314.20		316.20		337.50		344.70		357.30		369.00		382.50	396.90		408.60		424.80		436.50		448.20	900
303.00	123.00	317.00	132.00	330.00	141.00	348.00		362.00		375.00		393.00		407.00		420.00		435.00	451.00		464.00		482.00		495.00		508.00	1.000
344.30	146.30	359.70	156.20	374.00	166.10	393.80		409.20		423.50		443.30		458.70		473.00		489.50	507.10		521.40		539.00		555.50		569.80	1,100
384.00	168.00	410.80	178.88	416.40	189.60	438.00		454.80		470.40		492.00		508.80		524.40		542.40	561.60		577.20		598.80		614.40		630.00	1,200
420.40	191.10	454.60	204.10	461.50	214.50	484.90		503.10		520.00		543.40		561.60		578.50		598.00	618.80		635.70		659.10		676.00		692.90	1,300
464.80	212.80	484.40	225.40	502.60	238.00	527.80		547.40		565.60		590.80		610.40		628.60		649.60	672.00		690.20		715.40		733.60		751.80	1,400
505.50	235.50	526.50	249.00	546.00	262.50	573.00		594.00		613.50		640.50		661.50		681.00		703.50	727.50		747.00		774.00		793.50		813.00	1,500
545.60	257.60	568.00	272.00	588.80	286.40	617.60		640.00		660.80		689.60		712.00		732.80		756.80	782.40		803.20		832.00		852.80		873.60	1,600
586.50	280.50	610.30	295.80	632.40	310.10	663.00		686.80		708.90		739.50		763.30		785.40		810.90	838.10		860.20		890.80		912.90		935.00	1,700
618.20	304.20	653.40	320.40	676.80	336.60	709.20		734.40		757.80		790.20		816.40		838.80		865.80	894.60		918.00		950.40		973.80		997.20	1,800
668.80	326.80	695.40	333.90	720.10	361.00	754.30		780.90		805.60		839.80		866.40		891.10		919.60	950.00		974.70		1008.90		1030.60		1058.30	1,900
708.00	348.00	736.00	366.00	762.00	384.00	798.00		826.00		852.00		888.00		916.00		942.00		972.00	1004.00		1030.00		1066.00		1092.00		1118.00	2,000



Dragline and gold-washing equipment of the Prommel Mining Company, South Boulder Creek, Gilpin County, Colorado



A nearer view of the Prommel Mining Company's gold-washing equipment

conveyor stacker belt which operated independently of the dredge. This belt is mounted on five pairs of castors and was easily moved on timber runners.

On a test run of 2,223 cu.yd., the main dredge motor consumed 141 gal. of gasoline. At 12½c. per gallon, this totaled $17.63, making a charge of 0.008c. per yard. The conveyor-belt motor consumed 50 gal. on the same test run. This amounts to $6.25, or 0.003c. per cubic yard. The total cost of gasoline for these two motors therefore amounts to 0.011c. per cubic yard. Including oil and grease and small incidentals, together with a possible increase in the price of gasoline, and allowing for a yardage of 100 per hour, the total cost per cubic yard could reasonably be placed at 0.017c., as shown in the chart. Some medium-sized placer operations are using electric power, but in the operation here described the use of gasoline has its advantages.

The figure of 0.01c. per cubic yard for dredge maintenance is an approximation. Over the full placer season, the cost may be found to be somewhat lower, but the figure given is a reasonable one to use in making necessary estimates.

Colorado workman's compensation is a charge of $3.43 per $100 of payroll. Total payroll in this case is $2,097 per month. The amount charged to operation is $2.36 per day.

Depreciation is taken at 12½ per cent on $25,000 worth of machinery and equipment needed to carry on successful operations. This is distributed over 200 working days, the average placer season in Colorado. This charge would, therefore, amount to $15.63 per day.

The property is operated on a lease, and the owners receive 10 per cent of the net Mint returns. Inasmuch as this charge would vary with the different values of gravel, it is omitted in Table I but is included in every calculation of cost per cubic yard in Table II.

Under normal operating conditions the number of working days would be about 25 per month, with 5.5 days shut down for repairs and cleaning up. The latter must be charged against the gravel removed, and in this case amounts to $71.11 per day shut down. For 5.5 days the total charge would be $391.10. Distributed over the 25 working days this would give a daily charge of $15.60. The cost per cubic yard is determined by dividing the number of cubic yards per day into $15.60.

Each item in Table I is set into the column corresponding to the yardage to be removed. All of these items, added, give the total cost per cubic yard for a yardage ranging from 100 to 2,000 per day. The items of shovel gasoline and oil, shovel maintenance, dredge-motors gasoline and oil, and dredge maintenance are determined as fixed per cubic yard based on a yardage of 50 cu.yd. per hour up to 1,000 cu.yd. per day. These figures are also used in the tables from 1,000 to 2,000 cu.yd. per day, or on the basis of 100 cu.yd. per hour, using a larger shovel.

Table II—In considering Table II one finds that the lesser number to the left of the greater figure at the top of each column is gravel valued on the basis of gold at $20.67 an ounce. The greater figure to the right represents a 69 per cent increase for the same gravel with gold valued at $35 an ounce. Columns are included for values ranging from 20c. to 74c. per cubic yard, thus giving a sufficiently wide range for the placers of medium size. The figures in each column to the right of a given yardage show the cost per cubic yard of gravel having the value given at the top of the column. These costs are based on the data contained in Table I, save that the royalty is included.

Table III—This shows the approximate net profit that might be derived from the operation of medium-sized placers based on the operating costs shown in Table II. This is determined by subtracting the cost per cubic yard from the value of the gravel and multiplying by the number of cubic yards removed. The practical application of this table must naturally bring into consideration the value per cubic yard after recovery, the melting down of the gold at the Mint, the Mint charges,

and the fineness of the gold recovered. These factors can be determined closely after several shipments to the Mint.

These tables have a practical application in the calculation pertaining to portions or the whole of any placer area that may be determined from drilling or test pits, gold being taken at either $20.67 or $35 an ounce. They will therefore be found a convenient guide in ascertaining whether or not operations could be successfully maintained should the price of gold ever fall to $20.67 an ounce.

One must remember that the price paid today for gold is part of what it is costing the United States to get out of the depression. When calculations covering a period of years are being made, however, we find that the life of some of the medium-sized placers may be five to ten and possibly more years. We do not know what the price of gold will be at any time in the future, and should fortify ourselves with facts on a conservative basis. If a gold placer of medium size can show a profit with gold at $20.67 an ounce, its operation will unquestionably be successful as long as the price remains $35 an ounce.

Experimental Roaster for the Mesabi

Beneficiation Involves Converting Hematite to Magnetite And Concentrating on Drum-type Separators

EXPERIMENTS in roasting Mesabi hematite ore to magnetic oxide have been under way at Cooley, Minn., for the last two months in a test plant of commercial size, built cooperatively by the University of Minnesota and Butler Brothers, of St. Paul. The plant will handle 250 tons per day. Its feed thus far has been jig tailing from Butler Brothers near-by washing plants. This material runs about 40 per cent iron, in the form of hematite, and will pass a 1-in. screen. After being made magnetic by roasting, it is concentrated over drum-type magnetic separators, the concentrate running 63 to 64 per cent iron and in tonnage representing about half the original feed. The separators, it is understood, were taken from the plant of the Mesabi Iron Company at Babbitt, and rebuilt.

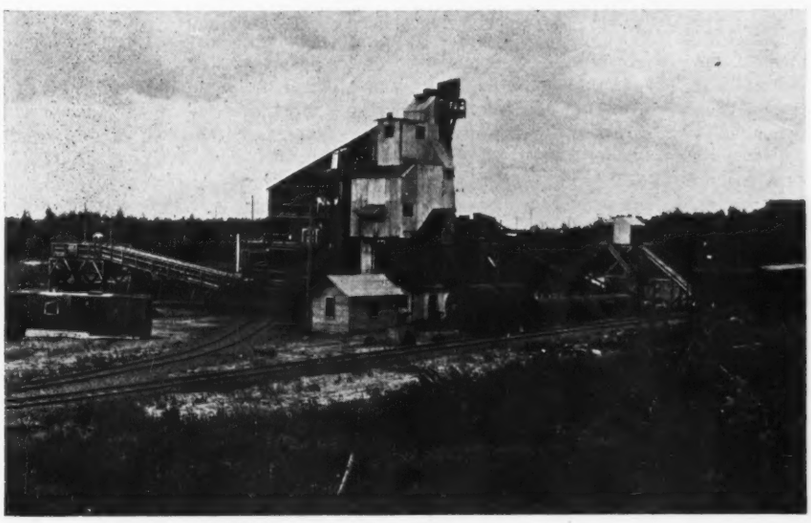
The jig tailings are dumped from 20-cu.yd. side-dump cars on a platform and elevated by a double-drum slusher to a small Symons cone crusher to reduce the oversize. From here the discharge goes to the bin.

The roasting furnace itself is of the shaft type and is kept filled with the ore or tailings at all times. Its height, to the top of the bin, is 52 ft.

As the ore is drawn down through the furnace by the action of the feeder plate at the bottom, it passes through three zones: first, heating; second, reducing; and third, cooling. Heating and reducing are effected with fuel oil, and the cooling is accomplished with water.

The installation should give the iron-ore operators of the range some accurate figures on beneficiating iron ore by this method. E. W. Davis is superintendent of the Mines Experiment Station, which is conducting the tests.

The new experimental magnetic roasting plant at Cooley, Minn.



Manganese Carbonate Discovery Increases Batesville-Cushman Reserves

Tom Shiras
Mountain Home, Ark.

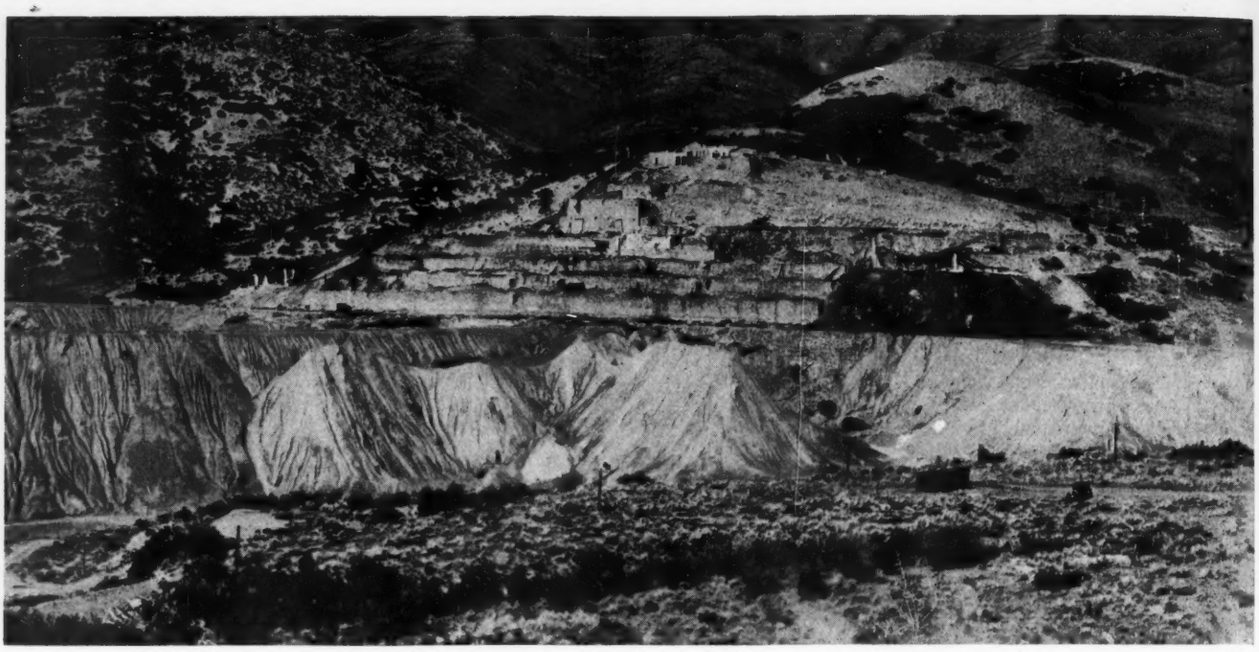
RECENT DISCOVERY of manganese carbonate in the Batesville-Cushman field, in Arkansas, has added thousands of tons to the potential ore reserves. The carbonate occurs in a blanket deposit hidden in the limestone ledges above the St. Clair limestone, and so closely resembles the latter that it is hard to detect except by its specific gravity. Locally, the carbonate has been given the name of "ledge" ore.

The old theory that the oxide ores of the field were laid down disseminated in the St. Clair limestone and left in the residual clays of the decomposed ledges has been reversed. Obviously, the carbonate is the primary ore. Abundant evidence shows that the oxides were originally carbonates.

In the Club House mine, one of the oldest producers in the field, in places where the carbonate ledge was exposed to weathering through a broken roof or a chimney, the chemical change is noted, the exposed part of the ledge being changed into oxide. The rich zones of carbonate ore are always found where a leakage occurs in the roof, this having apparently concentrated the values.

The main tunnel of the Club House mine, after twenty uninterrupted years of work, has been driven through the mountain by Walter H. Denison & Sons, operators. The property is a mile and a half west of Cushman, in Independence County. Prospecting on the other side of the gulch on this property has disclosed a continuation of the orebody into which a tunnel is now being driven. A semi-diesel engine, a compressor, and three jackhammers are being installed.

The property covers 80 acres. It has produced spasmodically ever since the Civil War. Mining has been carried on both by hand drilling and by jackhammers. Ore has been taken from approximately 3,500 ft. of tunnel and drifts. No milling has been done, only the boulder and ledge ore being saved. Both oxide and carbonate ores, running from 25 to 50 per cent metallic manganese, are produced. Output has been about equally divided between the low grade and the high grade. The vein varies from a few inches to 9 ft. in thickness. The operators state they have a market for all hard ore running about 35 per cent and that the production in the district this year will probably exceed that of 1933.



Old mill site and dumps of Consolidated Mercur Gold Mines

Mercur
Has New Hopes

Higher Prices for Gold and Silver and Improved Metallurgical Processes Cause This Old Utah Camp to Look Up Again—Four Groups Are Active

Gail Martin
Salt Lake City, Utah

GOLD'S ASCENT to a new high level, together with the ability of metallurgists to treat successfully the basic sulphide and arsenide ores of the Mercur district, in Utah, promises to make a new camp out of this abandoned area, productive in the past of close to $20,000,000. First a silver district in the 70's, Mercur, through the development of the cyanide process, became famous in the 90's as Utah's greatest gold camp. Here Col. D. C. Jackling, now renowned as the developer of the porphyry coppers, took a leading part as metallurgist in applying processes that had much to do with the later prosperity of the camp. Here, too, George H. Dern, former Governor of Utah and present Secretary of War, got his start as an operator in the Consolidated Mercur Gold Mines property, which his father, John C. Dern, had opened up.

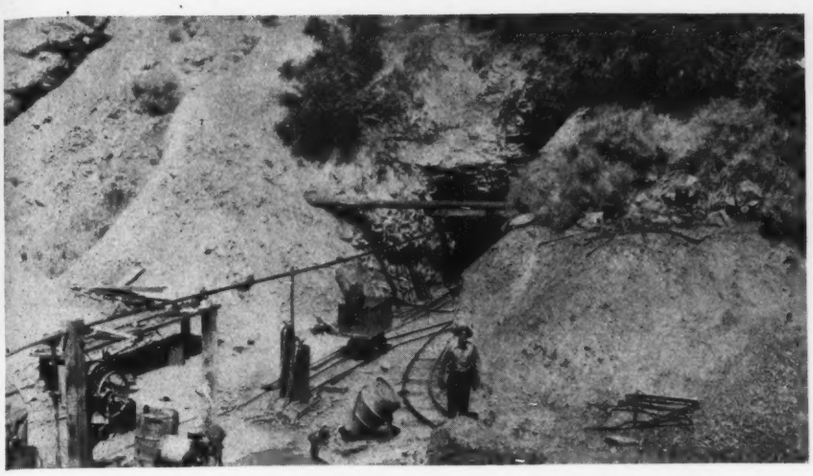
Several factors favor the reopening of the Mercur district under the leadership of W. F. Snyder & Sons, Salt Lake operators. Mercur is believed to have large ore reserves. Operations stopped because the complexity of the base ores defied economical treatment at the time.

Climatic conditions favor operations. The townsite of Mercur is less than 6,800 ft. above sea level. The main line of the San Pedro, Los Angeles & Salt Lake Railroad is but 13 miles away, giving easy access to Salt Lake Valley smelters. Only one flow of water was ever struck in the district. Power can be brought into the camp at a small cost. Local roads are good.

Present operations at the old camp fall into four classes: Those of W. F. Snyder & Sons in the Mercur ore horizon, of Pennsylvanian age, from which major production has come in the past; those of the Mercur Deep Mines Company, in the Lower Pennsylvanian limestones below the Mercur zone; those at the Sacramento and Geyser and Marion properties under the direction of G. R. Bothwell, of Salt Lake City; and those of the D. C. Gilbert group in the West Dip area on the west limb of the anticline.

To expedite development of the Consolidated Mercur holdings, W. F. Snyder & Sons have organized the Lewiston Peak Mining Company, E. H. Snyder president. This company has holdings of nearly 1,000 acres, comprising the old Brickyard, the Golden Gate, and the Mercur mines on the east limb of the anticline, the Rover and Gold Dust groups in the West Dip area, and the Sunshine group, at the south end of the range. The main purpose is to open up the old mines of the Consolidated Mercur group, where oxidized ores were stoped from the Mercur shales, 300 ft. thick. The ore, a replacement in shale, sandstone, and silicified limestone, lay in five beds—Upper, Middle, Mercur, Apex, and Magazine, at the base of which lay the Silver Chert limestone, productive of silver.

In some places, where the ore values were high enough, the whole 300 ft. of the Mercur formation was stoped and milled. Values for much of the tonnage mined over a period of years ranged from $3.78 to $4.25 a ton in gold with gold selling at $20.67 an ounce. According to Mr. Dern, who was general manager of Consolidated Mercur during the last years of its operations, the company left in the Golden Gate mine alone 1,000,000 tons of base ore averaging $3.50 a ton in gold, or close to $7 a ton on the present market. In addi-



Portal of Brickyard incline. The newly organized Lewiston Peak Mining Company is opening this old property of the Consolidated Mercur group

tion, a large tonnage is left in old stopes and workings, which, it is believed, can now be treated at a profit.

Operations are being centered on the old Brickyard shaft, which has been cleaned out to a depth of 300 ft. Here the company, under W. J. Franklin, general superintendent, has installed a compressor and a hoist. Samples are being taken for testing at the Snyder's Manning mill, 5 miles south. Five cars of development ore, ranging from $10 to $20 a ton in gold, have been shipped to Salt Lake Valley smelters. A better grade of ore is being mined by leasers from the Nimrod group, 1 mile south, from surface exposures. Sampling is being done elsewhere in the old workings. Work has also been started in the Rover group.

Development may result in building a mill at Mercur, although later the Manning plant may prove more convenient. The expense of building a 5-mile aerial tramway should not be prohibitive. At Manning, the Snyder interests have a 1,000-ton cyanide plant. Flotation could be installed, inasmuch as water is plentiful at Manning. Extensive experiments convince operators that by flotation and cyanidation the base ores can be worked.

Mercur Deep, headed by N. C. Christensen, president, plans to produce whatever pay ore can be mined near surface while it prospects deeper beds in the Lower Pennsylvanian underlying the Mercur formation. Faith in these beds is based on a new interpretation of ore occurrence in the district. Early reports on the area held that mineralization in limestone was disseminated by solutions squeezed from porphyry sills. Belief was general that the deposits were therefore local and found only adjacent to masses of igneous rocks. Recent study has proved that the so-called porphyry sills are not igneous sills but are highly altered limestones. The solutions, according to this theory, traveled up vertical fissures and were not squeezed from sills. One sees why early operators neglected to prospect the known productive limestones that in the Stockton, Ophir, and Dry Canyon dis-

Headframe and hoist building, Daisy No. 2 shaft, West Mercur, Utah

tricts, not far to the north, produced more than $46,000,000. H. G. Mitchell and associates made the geologic report on which the Mercur Deep Mines Company has projected its development.

On the west limb of the anticline in the West Dip mine, consisting of claims traversed for 2½ miles by the West Mercur vein, D. C. Gilbert is reopening the old property formerly worked by the Lewisohn brothers, of New York. Here 180,000 tons of ore, averaging 0.205 oz. gold, or about $8 a ton on the present metal market, was mined prior to 1917, when the mill burned down and the property was abandoned.

As the Mercur ore beds lie in the footwall of the West Mercur vein, mining will be carried on in beds higher stratigraphically than those being developed by the Snyder interests in the east limb of the anticline. The ore, carbonaceous in character and black as coal, can, in the opinion of metallurgists who have investigated the problem, be successfully treated by flotation.

Caved stopes north of the Brickyard incline

World Copper-Ore Reserves

A Compilation Shows an Increase —Russian Tonnage Included

Percy E. Barbour
Consulting Mining Engineer, New York

COPPER-ORE RESERVES of the world, as listed by myself in *Engineering and Mining Journal,* Feb. 23, 1931, totaled 88,542,000 tons of copper metal. The table presented herewith gives a total of 104,830,200 tons. As stated in the previous article, a final or complete total of such reserves cannot be compiled. The present article is a painstaking effort to bring together all the information available on the subject. Some of it is official, some semi-official, and some a compilation of careful estimates from reliable sources. The estimates for California and Tennessee and other states of the Union have been carefully made from past production figures published by the United States Bureau of Mines, giving due weight to the probable length of life of the various properties. The results may be accepted with reasonable assurance, so far as they go. Of course, notable omissions occur in the present table, just as notable additions have been made to the data given in the previous table.

Of the Clay orebody, owned by the Phelps Dodge Company in Arizona, Ira B. Joralemon says[1]:

"In the Clifton-Morenci district also the Phelps Dodge Company found that hundreds of millions of tons of low-grade ore lay between richer lenses. This Clay orebody at Clifton is, next to Utah, the largest of all American copper deposits. It will take $40,000,000 to equip it on the scale it requires, and $40,000,000 is more than the orebody is worth when the world has more copper than it needs. The Clay orebody must wait until copper gets scarce again."

Not necessarily scarce, but like many of the other huge reserves, the Clay orebody must wait for world consumption to catch up with present productive capacity.

According to reliable authority, the copper metal reserves of the United States are between 30,000,000 and 35,000,000 tons, of which 20,000,000 are officially reported.

The current trend in publicity is to overemphasize the Rhodesian coppers. Katanga is repeatedly referred to in the metropolitan press as the world's greatest copper mine, which it is not. The Chuquicamata, of the Chile Exploration Company, in Chile, is the world's premier copper mine. It has at least a thousand million tons of ore developed. The company has never found it necessary to make a final estimate of ultimate reserves. It has more copper in its known reserves than all of Rhodesia. It has between 93 and 94 per cent as much copper in its mine alone as Rhodesia, Katanga, and all the other African coppers added together. It can produce copper as cheaply as any other strictly copper mine in the world. This is in no way a disparagement of the extremely rich and important Congo and Rhodesian coppers, but just to keep the record straight.

The British companies operating in Rhodesia have a curious interlocking of holdings. Results of any one company may be published in several reports. If any of these reports are checked against this table the fact should be borne in mind that some of these company reports give the ore reserves in metric tons.

Ore Reserves of Soviet Russia

Russian tonnages will probably be accepted with considerable reservations. The mining engineers who practiced in Russian before the revolution are particularly skeptical about any new large tonnages having been found since their time. That, however, is an unsound attitude toward new discoveries. Waldemar Lindgren recently said[2]:

"You may not realize it, but in Russia there is a tremendous army of mining engineers and geologists examining the mineral resources all over the country, and they are perniciously active in writing papers—so much so, that you cannot keep track of them all."

Important discoveries in a territory as vast and as well mineralized, and as little developed, as Russia, especially as a result of these activities, should be expected.

Soviet figures from authentic sources have a way of disagreeing, which may be accounted for in part at least by different dates. Some of the figures are very new and some are very recent. The *Economic Review* of the Soviet Union, Jan. 1, 1931, estimates the reserves of the Kazakstan region as "over 500,000,000 tons of ore which will produce 7,000,000 tons of copper."

The Kounrad tonnage is that published in *Metal Progess* by V. M. Karmashov, while director of the Bureau of the Non-Ferrous Metal Industry, in 1931, during his residence in this country. The 20,000,000 tons of reserves in the Central Volga are claimed to have been discovered in 1933.

The Soviets are said to be prone to estimate large tonnages on too few drill holes. However, they have not seemingly been over-optimistic in stating their grades. A number of Soviet officials have been punished for systematically overstating production, according to the *Metal Bulletin.* The Soviet higher authorities are seemingly desirous of facts.

One does not have to accept the Soviet figures with complete assurance, but, on the other hand, no estimate of world ore reserves can well ignore Russian possibilities. Even if the tonnages were accepted without reservation, the time element in their exploitation is another matter. The tonnages need occasion no concern, because, if they are verified, we know by much experience that with money available on the scale of the South American or the Rhodesian development, a decade or a decade and a half would be required to get into normal capacity production. Besides, a world demand would be needed to encourage such exploitation. Neither such demand nor ample capital is at present available.

The *Metallwirtschaft*[3] states that, during 1933, Russian smelter production was only 70 per cent of the planned output. In considering the Ural plans for producing 24,100 tons of matte in 1936 and 56,200 tons in 1939, this paper states: " . . . but in view of the present state of the combine these esti-

[1] "Romantic Copper," by Ira B. Joralemon, page 233.

[2] Mining and Metallurgical Society of America, Bulletin 226, Dec., 1933.

[3] Through *Metal Bulletin,* London, April 20, 1934.

Copper-Ore Reserves of the World

	Tons of Ore	Grade, Per Cent	Copper Content, Tons
United States			
Bagdad	48,000,000	1.20	576,000
Consolidated Copper Mines	35,000,000	1.10	385,000
Inspiration	69,000,000	1.37	945,500
Michigan	100,000,000	1.00	1,000,000
Miami	85,439,180	0.96	820,200
Nevada Consolidated	300,000,000	1.47	4,410,000
Old Dominion	2,000,000	2.00	40,000
Phelps Dodge	388,146,550	1.13	4,386,100
United Verde Extension	227,800	6.17	14,100
Utah Copper	640,000,000	1.07	6,848,000
California, Tennessee, and other United States	78,000,000	2.01	1,567,800
Total United States	.....	....	**20,992,700**
Canada			
Britannia	10,000,000	1.30	130,000
Falconbridge	2,817,884	0.93	26,200
Granby	13,449,900	1.81	243,400
Hudson Bay	18,000,000	1.71	307,800
International Nickel	204,783,399	2.00	4,095,700
Noranda	23,345,000	2.65	618,600
Normetal	625,000	3.00	18,800
Sherritt Gordon	4,799,175	2.41	115,700
Waite Amulet	1,067,350	6.00	64,000
Total Canada	.....	....	**5,620,200**
Mexico			
Greene Cananea	40,000,000	4.00	1,600,000
Nicaragua			
Tonopah-Nicaragua	1,500,000	5.00	75,000
Cuba			
Matahambre	939,000	4.75	44,600
Chile			
Andes	137,400,000	1.51	2,074,700
Braden	240,000,000	2.20	5,280,000
Chile Copper	684,000,000	2.12	14,500,000
Chile Copper	316,000,000	4.00	12,640,000
Rio Blanco	42,000,000	2.39	1,003,800
Total Chile	.....	....	**35,498,500**
Europe			
Cyprus			
Cyprus Copper { Skouriotissa	20,000,000	2.10	420,000
Cyprus Copper { Mavrovonni (a)	.....	....	.....
Finland			
Outokompu	8,500,000	4.00	340,000
Spain			
Huelva (Rio Tinto, porphyry)	5,000,000	1.40	70,000
Sweden			
Boliden	6,600,000	2.00	132,000
Russia			
Kazakstan (region)	500,000,000	1.40	7,000,000
Almalik (district)	(4,000,000)	1.20	.....
Kounrad (district)	(125,000,000)	1.20	.....
Other districts	(371,000,000)	....	.....
Urals (region)	170,000,000	2.014	3,423,000
Turi (district)	(3,000,000)	5.50	.....
Uralmedstroy (district)	(12,000,000)	2.04	.....
Central Volga (region)	20,000,000	2.14	428,000
Total Russia	.....	....	**10,851,000**
India			
Indian Copper	700,466	3.05	21,400
Africa			
BelgianCongo			
Katanga	85,979,000	6.41	5,511,000
Sud-Katanga (Tchinsenda-Mokambo)	15,000,000	6.666	1,000,000
Northern Rhodesia			
Kanshanshi	10,925,000	4.34	474,100
Mufulira	162,000,000	4.14	6,706,800
Mufulira	(116,000,000)	4.41	.....
Baluba	(21,000,000)	3.47	.....
Chambishi	(25,000,000)	3.46	.....
Rhokana	270,780,000	4.30	11,643,500
Chingola	(2,000,000)	7.00	.....
Mindola	(28,000,000)	4.25	.....
Mindola	(39,000,000)	3.45	.....
N'Changa			
Upper	(93,000,000)	3.51	.....
Lower	(46,500,000)	6.90	.....
River	(2,280,000)	4.20	.....
N'Kana			
North	(45,000,000)	4.60	.....
South	(15,000,000)	2.95	.....
Roan Antelope	104,113,000	3.43	3,571,000
Total Rhodesia	.....	....	**22,395,400**
Transvaal			
Messina	1,305,600	2.40	31,300
Uganda			
Kilembe (Tanganyika Con.)	330,000	4.50	14,800
Australasia			
Mount Lyell	5,000,000	2.53	126,500
Mount Lyell	1,000,000	1.50	15,000
Mount Lyell	5,000,000	1.00	50,000
Mount Morgan	2,475,624	0.84	20,800
WORLD TOTAL	.....	.....	**104,830,200**

(a) Said to be richer than the Skouriotissa, but the figures are not available.

mates are, of course, absolutely illusory."

The table shows Russian reserves at 690,000,000 tons of ore, with 10,851,000 tons of copper metal contained. The Utah Copper mine has 640,000,000 tons of ore, containing 6,848,000 tons of copper. The Chuquicamata mine of the Chile Copper Company has a thousand million tons, or nearly 50 per cent more ore, and has more than two and one-half times as much total copper. The London *Metal Bulletin*[4] says, "The total copper reserves of the Soviet Union, according to latest estimates, amount to 15,000,000 tons." Even if this Soviet top figure were to be accepted without reservation, the estimate would mean for the whole Soviet Union only a little more than half as much copper as the Chile mine alone contains. Moreover, it would mean for Russia, with an area greater than the United States, copper reserves only a little more than half our domestic reserves, after this country has been producing most of the world's copper for nearly 50 years.

The Soviet plans, says the *Metal Bulletin*, have reached a stage where they merit fairly close attention on the part of competitive countries. In my opinion, however, a fair estimate of the Russian situation would be that the tonnage figures given are quite possible. But any copper developments they are likely to achieve in the next decade, or in two decades, are not likely to bring them into production on a scale that would make them enter the world market as serious competing producers. If they were able to supply their own needs, the loss of their current copper purchases in the world market would not be an important factor in the copper situation. In other words, one need not worry about Russian copper, one way or the other, but it must not be omitted as part of the picture.

Of the total known world reserves, the United States owns about 56 per cent. Including its share control in Roan Antelope and International Nickel, it owns or has an interest in about 60 per cent. The United States and Great Britain together own 83 per cent of the known copper-ore reserves of the world. At the rate of consumption during the last ten years, these known world reserves will last 65 years. This figure is merely indicative of the sufficiency of reserves. It must not be taken as a specific length of life, because the reserves are not completely known and the rate of the last ten years might be considerably increased; also, because 65 years is a long, long time to look ahead. But one may assert with perfect safety that no need exists for this generation to worry about where its copper is coming from. The reserves are not only in sight, but the plant to produce much more than the world has ever consumed is ready and waiting.

[4]May 8, 1934.

Labor and Metal Costs

Mechanization Doubles in Twenty Years

H. D. Keiser
Associate Editor

ONE of the studies made in preparing this series of articles included an estimate of the actual expenditures for labor per pound of copper produced in 1929. The purpose of this estimate was to provide a ratio between average earnings and labor costs. This estimate, as indicated in Table I, showed that in 1929, when the average price of copper was 18.107c. per pound, the amount paid per pound for labor was 4.21c. On the basis of the average earnings of copper producers over the period 1922-1932 and the average cost per pound of copper produced during the same period (*E.&M.J.*, April, 1934, Table I, p. 174), that is, 3.488c. and 10.09c., respectively, about 42 per cent of the cost was for labor expenditures; earnings represent about 19 per cent of the average selling price; expenditures for labor are about 23 per cent of the average selling price.

The aforesaid ratios, involving labor expenditures, earnings, and selling price, are believed to indicate the irreducible maximum and minimum conditions that must apply in the non-ferrous metal industry if it is to continue to contribute to the industrial advancement of the United States as it has in the past. Therefore, if the approach indicated by this entire study is reasonably accurate, these ratios would seem to constitute a datum point for the development of economic planning in the industry.

Table II presents employment statistics of the larger copper companies for the years 1927, 1929, 1931, and 1932. These figures show that in 1929 the number of men employed in mines, mills, and smelting plants of the copper industry was 45,000, as compared with 13,000 in 1932. The employment of 1929 represents less than a 2 per cent increase over that for 1919, whereas production, including secondary copper, showed an increase of nearly 90 per cent. This is indicative of the extent to which the industry has been mechanized.

According to the Bureau of the Census, Census of Mines and Quarries, 1929, the horsepower per man employed in copper production by decades from 1870 to 1929, inclusive, is as follows: 1870, 1.18 hp.; 1880, 2.24 hp.; 1889, 3.53 hp.; 1902, 7.63 hp.; 1909, 7.08 hp.; 1919, 12.00 hp.; 1929, 15.80 hp. Of these figures, those prior to 1902 are not explicit, having been derived.

Table I—Capital Investment and Labor Costs, 1929

Commodity	Average Earning in Dividends per Lb. (Cents)	Average Selling Price per Lb. (Cents)	Average Cost per Lb. (Cents)	Capital Investment per Lb. of Production (Cents)	Capital Investment per Lb. Rated Capacity (Cents)	Labor Costs per Lb. Actual Output 1929 (Cents)	Total Dividend Paid (Dollars)	Gross Value of Output (Dollars)
Copper	3.488	13.578	10.09	31.6	24.9	(b) 4.21	$488,645,319	2,150,313,779
Lead	2.011	6.687	4.676	(a) 5.48	(a) 5.3	(c)	147,026,216	954,071,603
Zinc	4.252	6.163	1.911			(c)	253,734,183	664,513,272
Total							$889,405,718	$3,768,898,654

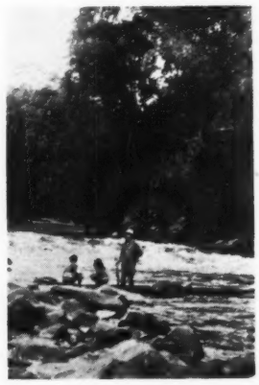
(a) The compilation on capital investment has been made on a combined basis of lead and zinc, as the production of these two metals is closely associated. With one exception, all the companies represented in this study produce both lead and zinc. (b) Estimated in part. (c) No estimates have been made for lead and zinc.

Table II—Employment Statistics for the Larger Copper Producers

	Mines		Mills and Smelters		Total	
	Average No. Men Employed	Man-shifts Worked	Average No. Men Employed	Man-shifts Worked	Average No. Men Employed	Man-shifts Worked
1927						
Class A	16,168	5,228,799	9,433	3,394,578	25,621	8,623,377
Class B	3,981	1,497,374	1,047	335,754	5,028	1,833,128
Class C	2,215	709,848	693	237,488	2,908	947,336
Totals	22,384	7,436,021	11,173	3,967,820	33,557	11,403,841
1929						
Class A	23,311	7,758,793	11,092	3,973,654	34,403	11,732,447
Class B	4,956	1,560,392	1,864	613,933	6,820	2,274,325
Class C	3,011	968,412	461	165,720	3,472	1,134,132
Totals	31,278	10,287,597	13,417	4,753,307	44,695	15,040,904
1931						
Class A	10,602	3,027,214	5,621	1,628,065	16,223	4,655,279
Class B	4,466	997,409	1,107	279,176	5,573	1,276,585
Class C	1,850	476,187	597	167,473	2,447	643,660
Totals—A, B, & C	16,918	4,500,810	7,325	2,074,714	24,243	6,575,524
All others	2,769	575,052	5,466	1,838,265	8,235	2,413,317
Totals, All Copper Plants	19,687	5,075,862	12,791	3,912,979	32,478	8,988,841
1932						
Class A	5,241	1,221,378	3,317	570,619	8,558	1,791,997
Class B	2,133	543,321	735	194,920	2,868	738,241
Class C	1,172	328,022	532	133,440	1,704	461,462
Totals A, B, & C	8,546	2,092,721	4,584	898,979	13,130	2,991,700

NOTE: Mills and smelters, Classes A, B, and C include only mills and smelters, whereas "Total" and "Total, All Copper Plants" includes some reduction works and refineries in addition to mills and smelters. Figures under "Mills and Smelters" include auxiliary labor around plants, such as construction labor and yards and shop labor.

This is the sixth and concluding article in a series devoted to a study of production costs, consisting largely of tables prepared by the Minerals Division of the United States Bureau of Foreign and Domestic Commerce.



What Can We Do About Silicosis?

Research Is Needed for a Surer Attack on the Entire Problem. Studies to Lessen the Production of Dust in Drilling, Blasting, and Ore Handling Are Especially Desirable

Benjamin F. Tillson
Consulting Engineer
Montclair, N. J.

TO THOSE who have acquired a thorough appreciation of the seriousness of silicosis as an industrial disease, its prevention looms as a most important consideration, for both economic and humanitarian reasons. Physical examinations of applicants may eliminate those most susceptible to the contraction of silicosis because of prior infections, abnormality of the respiratory tract, or other disorders. Control of the duration and frequency of the periods spent in dusty atmospheres may hold the exposures within the eliminative capacity of the human system. Periodical routine cleaning of the plant, dust surveys, and medical examinations may be made to insure effective elimination of the dust hazard. Further consideration of such factors is not here essential, in view of what has been said in preceding articles of this series. In this article attention will be focused on the physical devices for silicosis prevention and the research needed for a surer attack on the whole problem.

Attempts have already been made to formulate codes and regulations which would protect workers and industry from this oldest of vocational hazards, and the usual practices in vogue today indicate that little that is new has been added to the fundamental principles and practices reported by Agricola in his "De Re Metallica" in 1556; namely, suitable ventilation, and the covering of mouth and nostrils by a baffling or filtering material. According to a United States patent issued 70 years ago, it was then an old custom to squirt a stream of water alongside the drill steel in the drill hole. Also, United States Patent Office records 60 years old show water, air, or steam being used through hollow drill steel and drill bit to remove the rock cuttings and preserve the temper of the bit, although no mention was made of dust allaying. And in a Russian publication issued in Cracow 54 years ago the use of atomized fluids was described. But where mobility of workmen or the products is not necessary, we have adopted either the piping of a pure air supply to a mask or helmet worn by the worker, or have sealed the dusty working operations in a dust-tight chamber from which the worker is excluded. The ventilation may be of two types—the dilution of the dust-laden atmosphere to a relatively low dust content; and the removal of the dusty air as directly as possible. The former may be attained by either positive pressure or exhaust systems; the latter only by exhaust.

Codes and regulations have a useful purpose if they are not too intricate and specific; and they are prone to become so. The methods which are practical and effective in one plant and for a certain type of operation may prove impractical and ineffective where a different type or quantity of dust is involved. Consequently to dictate in general terms how dust prevention must be established is unfair and senseless, although the breathing atmosphere of the workmen may quite properly be specified. Even then, generalizations as to the dust content of a unit of respiratory air (either by weight or particulate count) may establish a dangerously false sense of security or may burden industry with unnecessary expenses. The nature of the dust itself plays too important a part to be ignored in the specifications of a suitable breathing atmosphere. For years we were told that only free silica dust was responsible for the serious fibrotic pathology of the lungs; pure coal dust and pure limestone dust were exonerated; and later we learned that asbestos dust produced a different but serious pulmonary disease. Now we hear that a silicate mineral, sericite, is equally as dangerous in the same manner as the free silica, quartz.

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Ideas underlying the physical devices used for catching dust are in the main old, according to the author . . . . . The particles that pass through the collector may be a source of greater danger than those it intercepts . . . . . Generalizations are dangerous—the advice of an engineering expert is desirable where treatment about a plant or mine is needed

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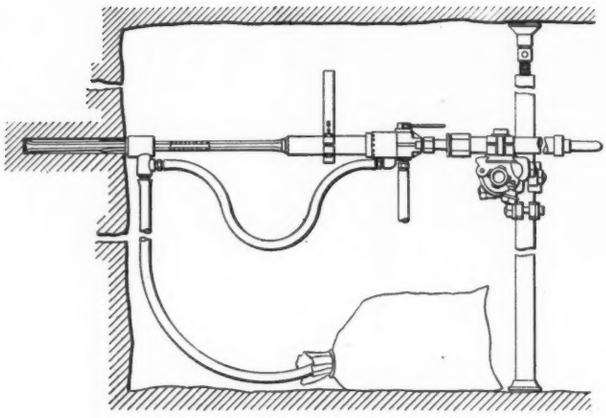
In addition to the chemical composition, the size and shape of the dust particles seem to play a most important part in the physiological damage they do. What injures the workman is not the dust in the atmosphere in which he works but that dust which he breathes and *retains* in his system. If they are readily eliminated by expectoration, coughing, or solution, only poisonous or corrosive dusts are hazardous. Even some inert dusts may safely be retained by the lungs in considerable quantity, for a man can live with only one lung functioning.

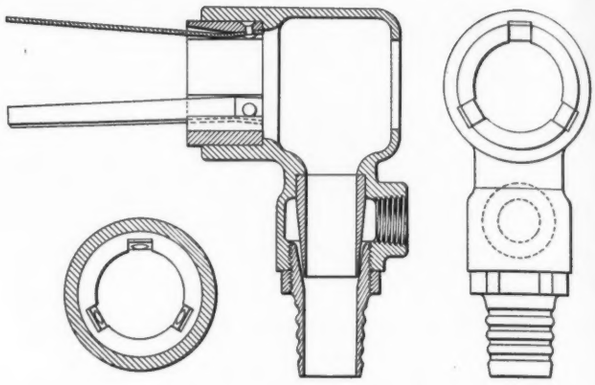
Therefore, sweeping statements in regard to preventive measures are as entirely out of place as the patent nostrums advertised to cure all our ills. In first-aid training one of the important instructions is to send for a doctor. To send for an engineering expert to prescribe the proper treatment for a plant fraught with dust hazards may be correspondingly important. The best treatment is that which assures the health and safety of the workmen with the least ultimate expense to the plant for the nature and quantity of production required. Such a treatment does not necessarily mean the addition of dust-catching appliances, nor an encumbrance with labor-wasting devices and operations; it should add to the general efficiency and may result in the substitution of a non-hazardous process for the one at fault.

Obviously, if no dust is made the dust hazard does not exist. The dictionary defines dust as "*fine, dry* particles of earth or other matter so comminuted that they may be raised and *wafted* by the wind." Three important factors we take the liberty of emphasizing by italics. To avoid the making of dust we might use tools and methods which did not comminute to fineness, or we might assure the wetting and agglomeration of all fine particles, or we might use substances of a great enough density and suitable form factor to prevent their being wafted by the air.

Apparently, sufficient attention has not been given to the invention of rock-cutting tools in the direction of assurance that large chips and little or no



A dust collector for drills—an ancient apparatus of modern aspects



Details of construction of dust-catching hood used with apparatus shown at the left

rock dust shall be produced. All of our rock excavation tools are woefully inefficient, and an unnecessary comminution of the rock is not an inconsiderable factor of this inefficiency. New types of drill bits, synchronism of blows upon the drill steel with contact of the drill bit and the rock, proportioning of the blows to the chipping penetration of the cutting edges, and suitable amplitude and speed of rotation, are all factors which need much further study to reduce the generation of dust from rock drilling. The use of dull drill bits aggravates the production of dust.

Though it is usually conceded that drilling is the greatest source of dust in rock excavation operations, blasting must produce much dust, as well as stir up the dust caused by drilling. Again, there is room for further investigations into blasting materials and methods which will produce less dust and will therefore be more efficient. A third source of dust in mines and excavations is the handling and transportation of broken material by shoveling, passage through raises and storage pockets, and the impact in loading operations. I know of no studies that prove the relative importance as dust generators of these various types of operations—drilling, blasting, and handling. The dust present with the last named probably originates chiefly from the two former. When the broken rock gets to the preparation plant still more dust is produced by crushing and screening, to the detriment of efficiency and maintenance.

The factor of dryness is important, and so the use of water has been customary in drilling from ancient times; but with hand drilling those holes sloping above the horizontal were all probably drilled dry. There is no reason why a reservoir of water could not be located higher than most of the holes and a jet of water played into the hole from a tube, but I have not noticed any mention of nor seen such a practice in operation. Though to wet the larger chips in such an operation is not difficult, it seems to be increasingly hard to wet the particles, as they are finer. Two surmises are commonly offered—one that a film of air is adsorbed to the surfaces of the very small particles and prevents their wetting and agglomeration into larger particles; the other that very fine particles carry electrical charges of the same polarity as the water and are repelled from it and each other. Much investigation has been made in respect to surface tensions of fluids and their use as dispersing and coagulating agencies in the handling of slimes, but little of such knowledge has been applied to the problem of dust prevention. Fluids of lower surface tensions, and therefore of greater wetting power, are cheaply available, but little use has been made of them in our rock-drilling problems. Even when water tanks were used with wet drilling, how many mine operators thought of dropping cakes of soap in them?

Of course, so little consideration was given in the past to the health hazard of dust that the prime object was to keep the bottom of the drill hole free from cuttings so that more effective cutting blows would be delivered against the rock. Therefore water, steam, and compressed air, or mixtures of compressed air and water, were used as scavenging agents, either intermittently by the use of blowpipes or continuously (or at each stroke) through hollow drill steel. Of course, the large bubbles of air carried dust particles through the water and liberated them in the atmosphere. Recognition of this fact resulted in stringent rock-drill specifications in the Transvaal, prohibiting the usual American standard of rock-drill front head in which there could be a leakage of compressed air down the hollow drill steel with the water supplied for wet drilling. This practice reduced the dust content of the atmosphere but did not eliminate it. Where holes are drilled sloping above the horizontal, the working place will be unhealthily wet if enough water can be used to fill the cross-section of the hole with water, so that dry dust can be blown out, or some will even fly out where air is not used through the hollow drill steel.

At a prize contest in the Ruhr some years ago the award was given to a process for generating and passing a foam through the hollow drill steel. The following merits are claimed for it: one gallon of liquid per hour per drill will suffice where 40 to 100 gal. of water per hour are usually used; the foam catches and coagulates the dust particles; and the expanding bubbles of foam fill the borehole so that no dust can escape contact with it. The foam-forming concentrate is about 1 per cent of the foam solution in the supply tank, and the remainder is water.

In the process called sandblasting we can obtain similar abrasive results by the use of steel shot or grit instead of the silica sand. With steel we are using a denser medium which stays in suspension in the atmosphere to a lesser degree and is less likely to be wafted by the air and inhaled. But when it does enter the respiratory tract the pathology of silicosis is not produced. Therefore, since silicosis requires certain chemical compositions, the avoidance of them offers another method of prevention. Artificial abrasives can be used in place of the natural sandstone wheels, for example, and other abrasive particles may be substituted for silica sand. The abolition of silica and sericitic material in molds would prevent the dust hazards associated with shake-out operations, tamping, and sand-conditioning operations in foundries. Investigation of substitutes may be worth while. The makers of steel abrasives claim that one carload of steel shot will do the work of forty carloads of sandblast sand—that is, 2 tons of sand is equaled by 100 lb. of steel grit—and that steel will prove cheaper in the long run.

However, it is possible to isolate such processes as sandblasting and tumbling and either to perform the operations in sealed chambers from which the work-

man is excluded or else to equip the operator with a positive-pressure helmet which will afford complete dust protection. The use of helmets without positive-pressure air supply assumes unknown risks that are best avoided if possible.

Old Ideas and Patents

Sixteen years ago a United States patent was granted for a respirator mask supplied with positive air pressure through a pressure-reducing valve and oil filter from the compressed-air line which operated the rock drill, or from a tank carried by the worker. Similar schemes have been proposed during the past year in England and the Transvaal. Ideas crop up again, strangely enough, after having sunk into oblivion, and are acclaimed as new advances because the needs of the times make them more attractive. Such a situation also appertains to "dust traps" that have been devised for rock drilling.

If dust must be formed, its capture as near as possible to its source becomes a desirable procedure. Exhaust systems from suitable enclosures or hoods and delivering through cyclones, baghouses, electrical precipitators, settling chambers, washers, filters, or other dust-catching appliances are commonly employed. Their arrangement varies with the applications which must be made, but wear of fan blades and housing is avoided if the fan handles the cleaned air. The design of the hood inlet must be such as to take advantage, if possible, of the trajectory of the dust particles and to provide entering air currents of sufficient velocities to entrain the dust particles of a hazardous size. The principles are well known, but the applications have not always been made intelligently. The almost total lack of engineering tests has been responsible for such a state of affairs.

In rock drilling, dust-collecting hoods have been known for about forty years. The intent when they were first used was to seal them to the rock face around the drill hole and also seal them to the drill rods, connect them to filtering sacks, or discharge nozzles immersed in water, and rely upon the positive pressure of air through the hollow drill steels to convey the dust from the borehole to the dust collectors. About thirty years ago an exhaust system was patented in connection with a sealing hood of rubber or other flexible material which permitted the entry of the drill steel, and which bore against the rock face. Exhaust systems with dust-collecting hoods were installed in the granite-surfacing shops at Barre, Vt., about twenty-five years ago, and the first application to rock drilling which did not contemplate a sealing of the hood to the drill rod or the rock face was made about the same time. Quite obviously, if the exhaust apparatus were designed to handle a sufficient quantity of air, the dust would not escape from the hood, as the direction of air flow would be into the hood. I employed such a device successfully at that time, but found that patent applications had been filed by another several years prior. The illustration of the apparatus presented on p. 452 is from the patent specifications, and shows that there was no intention to make an air seal between the hood casing and either the rock face or the drill rod. Fourteen years ago another United States patent with a single combination claim which includes a "casing (hood) having one end open and a flexible cover for the other end having an opening therein for the passage of the bit" recites in its body: "I have found it is not necessary to place the mouth of the casing against the wall, as the suction will be sufficient to draw the dust and particles of material into the casing when the mouth of said casing is spaced a distance from said wall." These patents are mentioned because of public misconceptions as to the exclusive nature of dust traps which have appeared upon the market in England and this country in recent years. Tests, however, have shown that such devices can serve a useful purpose in reducing the dust content of the atmosphere adjacent to a rock-drilling operation. A modern fan exhauster and filter unit is here illustrated in connection with a drilling operation, in the accompanying halftone.

Courtesy of Spencer Turbine Company

Dust prevention today in quarry and open-pit work. The suction apparatus

Masks and Respirators

Besides the removal of dust at or near its source, or its dilution in the atmosphere by adequate ventilation, another preventive measure is the use of hose masks or respirators. The former provides clean foreign air directly to the respiratory system of the worker, and the latter supplies cleaned local air. Both are in disfavor because of the annoyance and discomfort to the wearer and his consequent tendency to discard them in hazardous atmospheres. The old types of respirators with damp sponges often became unsanitary and offered an objectionable breathing resistance. The moisture exhaled from the lungs tends to condense on the filtering medium and to cause the dust to clog it sufficiently to increase its resistance to air passage. Exhalation valves, similar to those on approved army gas masks, have now been added to alleviate that condition. It is reported that the United States Bureau of Mines tests a few years ago on a large number of different types of commercial dust respirators showed that the maximum filtering efficiencies were only about 50 per cent. The sealing of the face masks to the contours of the face has also been poor. However, in England and in the United States during the past year new types of respirators have been developed; and they are said to have remarkably high filtering efficiency on dust particles of dangerous sizes, a low resistance to breathing (for one type 0.28 in. water head to pass 85 liters, or 3 cu.ft., of air per minute through 23 sq.in. of filter surface), light weight (about 4 to 5 oz.) and to be comfortable to wear for long periods. No definite test figures have been made available to the public, but the United States Bureau of Mines is formulating a testing procedure on the basis of which it will issue certificates of approval to respirators meeting its requirements.

The Dust That "Passes Through"

For too many years the public has been buying and using dust-catching equipment and respirators without knowing what it was getting nor whether it was safe or suitable for its needs and expectations. At last there seems a possibility that a beginning will be made to rectify that situation. When only industrial processes were involved, it was not so important whether an air washer or dust filter really caught all the dust that it was guaranteed to catch.

But with human health and life at stake the matter becomes vital as to *what dust it lets pass through,* not what percentage it catches. One who should know has said that not a dust-exhaust system in this country has been installed with rigorous enough knowledge of its performance as to assure meeting dust-count guarantees in regard to dust collecting or filtering efficiency. Rule-of-thumb methods have largely superseded research determinations for the basis of designs. The movement of a sufficient volume of air might, however, assure the reduction of dust content at the working place to safe limits shown by subsequent dust counts. That may seem to be of sole importance, but what becomes of the dust in the air discharged, and probably of the most dangerous sizes? Again, we may ask what disposal has been made of the dust which has been caught? Is it piled up in the open for the wind to blow around? Such situations do exist. Somewhat similar circumstances may occur with piles of flotation tailings at ore-concentration plants. Has anyone investigated the possible hazard from them?

To me there seems an unquestionable need for a coordinated research program of a scope too extensive for any one agency to undertake. Able work has been done by various institutions in fields limited by resources, staff, and time. The results of private investigations are not made available to the public, and consequently cannot be correlated. Missing links must be supplied to join the researches of independent bodies and a general scheme must knit the whole together. Such a research program was proposed at a silicosis session of the annual meeting of the American Institute of Mining and Metallurgical Engineers in February of this year. It was approved by the considerable number in attendance and a large university offered to sponsor it. In so far as I know, no start has been made, although seven months have elapsed. Is this another indication that industry and our private institutions are leaning more and more upon the Federal initiative and control which is so often decried? If industry does not recognize its opportunity and duty to protect itself and its workmen, then, in the public interest, it certainly devolves upon our national Government to meet the needs of the occasion. The extensive nature of such a project is shown by the following program:

Proposed Pneumonoconiosis Research Program

Scope

The consideration of all non-viable dusts whose inhalation is vocational or a public hazard because of their functional disturbance of physiological processes. Silica (quartz) and silicate dusts should receive first attention.

Causation

A—Case history of exposure; including—

1. Engineering analysis of types of work and working conditions and nature of rocks and minerals involved.

2. Medical history of infections and diseases experienced and their residual effects, and present physical and health status.

B—Post-mortem investigation of lung structure and contents—

1. Petrological and chemical examination, and the development of instruments and technique for unusually high magnifications and determination of minute particles and their composition, form, and size distribution by engineering technology.

2. Biological examination of lung tissue and processes.

C—X-ray examination of removed lungs—

1. Development of mineralogical technique on finely dispersed minerals in the tissues without exposures dangerous to life processes.

2. Development of roentgenological technique and positive interpretations.

D—Experiments with dusts upon living animals and tissues—

By pathologists, biophysicists, and biochemists. (After the arts of ore dressing and chemical engineering have prepared dusts of proper purity and content.)

E—Statistical analyses of the incidence, occurrence, and distribution of diseases, symptoms, minerals, and size or form frequency of dust particles, by, respectively, industrial hygienists, statistical mathematicians, geologists, and chemical engineers.

F—Sampling, weighing, counting, measuring form factor and size distribution, and mineralogical determination of dust particles in the air supplied for respiration, also the determination of sizes and forms remaining in suspension under various conditions and most likely to be inhaled. This will require cooperation from chemical engineers, mechanical and ventilating engineers, petrologists, physicists, microscopists, physiologists, and possibly electrical engineers.

Developments in apparatus and technique will require much work in the field of pure science to permit thorough investigation of particles ranging in size from ½ micron down to 1/10 micron, by light as short as or shorter than 2,000 Angstrom units.

Prevention

A—Mechanical aspects requiring investigations of mining, metallurgical, civil, mechanical, electrical, and chemical engineers—

1. Dust collectors, cyclones, baffles, classifiers, traps, centrifuges, filters, and electrical and polarizing apparatus.

2. Respirators—traps, filters, adhesive surfaces, and similar devices.

3. Sprays of water and other fluids with lower surface tension—their atomization and application.

4. Foams—in rock drilling, settling a dusty atmosphere, and in blanketing dusty surfaces and masses (their composition for bubbles of right surface tension, size, tenacity, fluid content, and their disposal).

5. Ventilation methods and apparatus; studies, with particles of various shapes, sizes, and specific gravities, suction and insufflation, carrying velocities, free settling, impact, and changes in direction of flowing currents.

6. Air conditioning—effects of humidification and temperature regulation, and most suitable apparatus.

7. Rock-drilling appliances and methods—to avoid formation of dust of dangerous sizes and shapes and to prevent liberation of the dust to the breathed atmosphere.

8. Blasting methods and materials—to avoid the production or stirring up of dangerous dusts, to permit the absence of workmen from a temporarily dangerous atmosphere, and to settle resultant dust from blasts.

9. Crushing and grinding apparatus and methods for rock and metals—to avoid formation of dangerous dusts or prevent their liberation to workmen's detriment.

10. Handling and transporting of broken rock—so as to avoid the increase in fine particles of dust and the liberation of those present.

11. Positive-pressure gas masks and pure-air supply systems—tests of their effectiveness both in avoiding the inhalation of dusty air and in their economic utility.

B—Medical—

1. Development of therapeutic reagents to assist the human system in voiding inhaled dusts.

2. Experiments with protective inhalants to assist the trapping of dust in respiratory passage, from which it will be ejected by natural processes.

Symptomatology

A—Clinical observations and tests.

B—Establishment of pneumonoconiosis clinics and wards.

X-Ray Investigations

A—By engineering science—

1. Methods and apparatus for automatically providing correct exposures based upon the quantity of roentgen rays which have passed through the body and the photographic film.

2. Studies in the possibility of deflect-

ing roentgen rays so as to focus them or produce a parallel ray beam.

3. Methods and apparatus for the determination of the presence and nature of mineral particles in tissue without injury to the individual containing them.

B—By roentgenologists—

1. For further developments in teleradiography (influence of distance away from the tube upon the definition of pathological conditions).

2. Further developments in stereoradiography (the value of perspective and three-dimensional viewing of lung tissue).

3. Study of the effect of exposures upon diagnosis.

4. Standardization of differential diagnosis between various pneumonoconioses and also between various other diseases and pathological conditions which give shadows simulating various phases and details common to pneumonoconiosis.

5. Studies of the postures and preparation of the organs so as to facilitate more complete and definite viewing of the lung pathology.

Physiopathology

A—Cooperation of chemists and physicists in the problems of biologists—

1. Studies of the solubility of various minerals in various body fluids and protoplasms.

2. Study of electrical effects in body processes, polarization of cells and dust particles so as mutually to attract or repel each other, as may be advantageous; electrolytic factors in respect to solutions and toxic effects.

3. Study of organic and mineral colloids in the body, their peptization and dispersion.

4. Control of the mobility of dust-laden phagocyte cells and their aggregation.

5. The detection of toxic silica, or resultants from other dangerous dusts, in the body fluids or processes prior to injurious effects.

B—Cooperation of engineers and pathologists—

1. To determine the minimum exposures for various dusts to produce detectible pathological changes and symptoms.

C—By pathologists—

1. Study of the progressive effects of dust particles after removal of the exposure.

2. Determination of the maximum time after removal from exposure that may be required to show pathological injuries.

3. Studies of phagocytosis and fibrotic growths.

Therapeutics

A—Cooperation of engineers and medical scientists in apparatus and methods for voiding residual dust from the lungs by local inflammation or phagocyte migration by the use of—

1. Diathermy, focused to produce higher temperatures in deep-seated tissue than in the other tissue traversed.

2. Electrotherapy of unusual frequency, perhaps even a radio-frequency.

3. Super-sonic vibrations.

B—Medical studies in medication which may void residual dust and dust-laden phagocytes by chemical irritants and antitoxins, and control of local conditions of alkalinity and acidity.

C—Medical studies in medication to promote growth of sound tissue to replace morbid tissue in the lungs.

Prognosis

A—Cooperation of medical profession and actuaries, to determine the expected life span of those suffering from various forms and stages of pneumonoconioses, and its comparison with normal life expectations.

B—Cooperation of doctors and engineers—

1. To determine the amount of disability of the subject in his vocation.

2. His ability in other vocations, and

3. The economic loss he has sustained.

Medicolegal

Cooperation of engineers, doctors, and lawyers, for the preparation of model laws for different pneumonoconioses to protect and serve labor, industry, and the public most fairly—

1. In the development of safety codes and standards by the engineering and medical professions.

2. The filing and indexing of reports on compensation board and court actions in respect to various pneumonoconioses.

Library

1. The assembly, briefing, and indexing of all literature dealing with the different phases of this research.

2. Translation into English of all foreign articles which are determined to be of fundamental factual importance.

Outlook Favorable for Increased Gold Production In Venezuelan Guayana

Frank W. Gravlin

118 West 83d St., New York

GUAYANA, as the section of Venezuela where the known alluvial and lode deposits exist is called, has been extensively examined by American interests in the last two years. Previously, save for a small dredging operation on the Yuruari River and a 40-ton amalgamating mill in the Botanamo area, operations were carried on solely by English and French capital. The largest project is sponsored by a former oil man who has had extensive experience in Latin America. Engineers in the employ of the syndicate headed by this man have made an exhaustive survey of the area, and their reports agree that large-scale operations should be profitable. The syndicate expects to utilize the power of the Caroni River falls. Later, a railroad, connecting the district around El Callao to deep-water transportation at a port on the lower Orinoco, may possibly be built. This would permit the development of many lower-grade mines now unworkable because of the high freight costs.

At present, all material shipped to the mines must be transferred at Port of Spain, Trinidad, to flat-bottomed river steamers which run up the Orinoco. At San Felix it is transferred to trucks for the trip to the mines. During the rainy season trucking between San Felix and the mines is impossible for long periods.

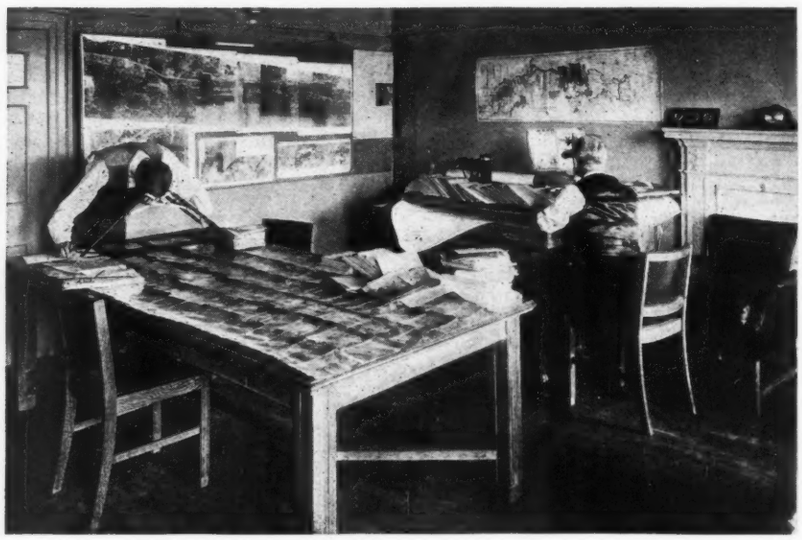
A Mid-Western mining man spent several months in the district early this year, and, although favorably impressed, will not continue with his plans until he can make a more complete investigation. A third group consists of San Francisco interests furnishing the capital, a number of Americans resident in Caracas who are acting as promoters, and several Venezuelans who own the properties that the company will operate. Preliminary work is scheduled to start this fall. This is a partnership, and no stock will be sold.

In view of the present high price of gold, one may wonder why Guayana has not had more of a boom. This can be explained by several reasons. Briefly, the most important ones are the inaccessibility of the field, the present high cost of labor and local products due to the fact that Venezuela is still on a gold base, the understandable desire of the Venezuelan Government that only adequately financed companies shall enter the field, and, lastly, the fact that so little is known about Guayana, either geologically or geographically. The records of New Goldfields and Botanamo show that here, as anywhere else, a soundly managed and solidly financed company will succeed. Purchase of the iron deposits at Imataca by the Bethlehem Steel Company may be what has been needed. This entrance into Venezuela by one of the great steel companies may be the opening gun.

Surveying the Witwatersrand From the Air

A London Firm Undertakes the Task on Its Own Initiative—The Project Is Expected to Prove Profitable as Well as Highly Informative

George L. Walker
31, Ashley Road
Epsom, Surrey
England



Where the aerial photographs are arranged in order and examined under the stereoscope

THAT the Witwatersrand gold-mining district of South Africa, commonly called the Rand, is being surveyed from the air has been in the news for some time. The survey was not ordered by the mining companies, but is being paid for by those conducting it. This makes it look like an advertising stunt. It is; but it is also much more than that.

Here is the story: H. Hemming & Partners, of London, is a firm made up of men who have taken active parts in numerous air surveys. These men got together to utilize the knowledge they had gained by experience. They have systematized the methods of making air surveys in accordance with engineering technique, and have made an intensive study, from the business viewpoint, of the advantages the surveyors have to offer to the owners of the properties surveyed.

The objects this firm had in view when determining to finance an air survey of the Rand included showing its goods, selling its goods, and creating a demand for its services in South Africa. It formed a subsidiary company, Geological Air Surveys, to do the work, and do it in the manner the members of the firm believe such work should be done. The expectation was that pictures could be sold to some of the companies operating on the Rand, and I understand that this is already proving to have been justified. But whether this experiment will prove that it is a paying enterprise to have an old and extensively developed district like the Rand surveyed from the air must be left for the future to decide.

Methods Employed

To get the results desired, the vertical photographs must be taken from the same altitude. Those who have tried to fit them together when taken from different distances will understand the reason. Every foot of the area must be shown on the films, and a relatively uniform overlap has been found essential. These requirements necessitate the employment of skilled pilots and photographers, and also that the work be carefully planned and the plan adhered to strictly.

When surveying undeveloped areas, both vertical and oblique photographs are often taken. In the Rand area of about 2,000 square miles, only vertical photographs were required. The boundaries of this area were first flown over and photographed. This was followed by flights back and forth from north to south. These latter flights were planned to cover the entire area so systematically and with such precision that the photographs would overlap 60 per cent fore and aft and from 20 per cent to 33 per cent on each side. The reason for such overlapping will become apparent.

An Eagle camera is used, and it is mounted so as to be adjustable for the drift and tilt of the plane. Exposures are timed automatically. The serial number, the height at which the exposure was made, and any notes required are automatically recorded on the margin of each photograph.

Handling the Photographs

When the photographs have been printed, the serial numbers and notes on their margins enable them to be filed in sets which cover the numerous blocks of area in rotation. This having been done, those showing the property of any given mining company are available for re-examination and inspection at a moment's notice.

The overlaps of the photographs, and their having been taken at equal distances from the ground, permit of their being fitted together, trimmed, and mounted on cardboard in such a manner as to form a complete mosaic of either the whole area or any desired portion of it. These mosaics are then enlarged, a special camera having been developed for this purpose. The originals and enlargements may also be filed.

What the Photographs Show

To the casual observer the photographs show little except the surface and what is built or growing on it. But to one skilled in the study of such photographs they may reveal indications of the geology beneath the surface. Those taken of the Rand show the outcropping strata so clearly as to permit of their being traced in some places, and to a geologist they may also reveal the fault systems.

Due to overlapping, the same ground is usually shown in two photographs, this making it possible for them to be so

adjusted as to be looked at as one under a stereoscope. When so seen every feature of the surface rises or sinks to its proper level and the topography becomes distinctly clear. This method of examination also reveals the changing types of vegetation, a feature which is of particular importance.

That the types of trees and shrubs change where the hidden geological formations change, due to different vegetation favoring the soils created by the decomposition of some rocks more than others, has long been recognized. Even when the same families of trees and shrubs persist, their character and distribution alter where the soil does.

Photographs taken from heights of 8,000 to 10,000 ft. often show continuous belts of different types of forest marking different beds of buried strata. Where no vegetation occurs, they similarly bring out those differences in the coloration of the soil which tell of different parent rocks. These features, difficult to recognize on the ground, are brought out compellingly in the photographs.

If aërial surveys of mineral areas are to continue growing in popularity, they will have to demonstrate that they often prove worth many times what they cost. The survey of the Rand is expected to show that, had it been taken many years ago, the expense of a great deal of wasted exploratory work would have been saved. But who will take the pains to compare the photographs with the maps of the older workings and then "tell the world" what he discovers?

The claim seems well founded that aërial photographs will show the geologist where he can most advisably start investigations and where he can best concentrate his work. If so, they should often expedite the work of finding the ore. Rumor has it that the photographs point to the probability of ore being found in portions of the Rand hitherto neglected.

To survey an area like that of the Rand, 2,000 square miles in extent, entails over 3,500 miles of flying and the taking and printing of some 10,000 photographs. By the time the photographs have been fitted into mosaics and enlarged the cost will have reached approximately £30,000; that is, to the buyer of the service.

Like all other exploration and prospecting work, the aërial survey fails to find economic minerals in areas where none exist. That now seems to have been the reason why the considerable amount expended on an aërial survey of the copper concession in Northern Rhodesia some years ago appeared for the time to have been wasted. The survey in question was of a very large portion of the Rhodesian Congo Border Concession, and it did not include the N'Kana Concession, which was then controlled by Rhodesian Selection Trust, Ltd. All the new deposits of copper ore —Roan Antelope, N'Kana, Mufulira, Chambishi, and Baluba—are inside of the N'Kana Concession, and Bwana M'Kubwa and N'Changa are very close to its borders.

Since that survey was completed, the area covered by it has been prospected thoroughly on foot, and practically nothing of importance discovered—nothing except the N'Changa West deposit, which had no outcrop. Aside from the latter all the big discoveries and developments of copper ore have occurred within the N'Kana Concession, which was not included in the aërial survey. One might argue from this that the survey was, even if in the negative sense, of real value.

Over the Rand. The widespread faulting and folding of this area will be readily apparent

A Prospector's Dream

Pockets of High-Grade in the Ollie Jordan Gold Mine Vie in Interest With Unusual Nature of Occurrence—Luck Does Not Delay in Coming to This Venturer

Karl Kohler, Jr.
Mining Engineer
Ellensburg, Wash.

SOON after having worked five days on an undeveloped prospect that he had purchased in the Swauk mining district, 24 miles north of Ellensburg, Wash., Ollie Jordan brought the property into production with the discovery of 600 oz. of coarse gold. The mine has been producing ever since. The property, which was bought in September, 1932, is about half a mile east of the old mining camp of Meaghersville.

Several types or gold deposits occur in the district, all in the Swauk formation, a sedimentary series of shales and sandstones of Eocene age. The deposits differ in their structures and their associations with the intruding basic igneous rocks. The Ollie Jordan is immediately associated with the basic instrusives, all of the present workings being around a diabase intrusion.

These workings are located near the top of a small northwest-southeast ridge about halfway up a mountainside. Three of the openings are the West, South, and East drifts, respectively. The portal of the West drift is at the west end of the ridge, that of the South drift on its south slope, and the face of the East drift is only about 35 ft. below the surface, headed into the mountain.

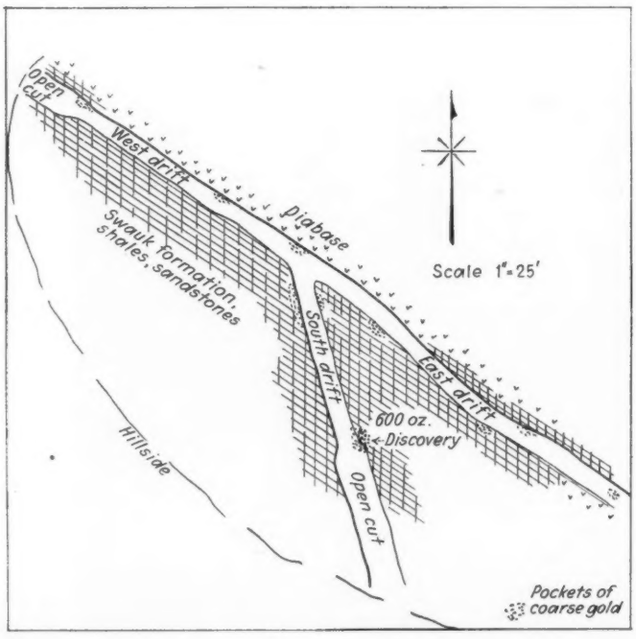
Work was begun on a small seam in the sandstone directly above the portal of the South drift. At 4-ft. depth the seam passed into loose shale, and the pocket mentioned was discovered. The gold was very coarse, having fern and wire gold entwined and snarled into almost solid masses. Little gangue mineral was associated with this pocket, some of the gold occurring in cavities in the shale and some being mixed with calcite and other soft, weathered gangue minerals. This seam was then followed north until it was cut by the diabase intrusive, passing through a rich pocket about 10 ft. from the junction and disclosing another at the junction. From the discovery pocket to the junction it gained in width until it took in almost 2 ft. of mineralized material at the diabase and was standing almost vertical. From this junction drifting was started both ways along the intrusive, and the West drift was driven to the surface. A mineralized zone was followed all along the dike, sometimes against the diabase and other times being 4 or 5 ft. south of it. This zone contained calcite as the predominant gangue mineral, a few sulphides being seen at times and in one place a small amount of quartz. The calcite occurred in patches, some of it in large crystallized masses up to the size of a melon here and there through the shale, and also in many short irregular seams. Against the dike the material is harder and frozen to the walls, and only in a few places along the drifts has the diabase been exposed. One of these exposures is noted at the face of the East drift coming in from the south and opposite from the main intrusive.

The accompanying sketch map shows the location of a number of the larger pockets found along the drifts, ranging in size from 8 to 200 oz. To date only one mass of gold has been found in contact with the diabase and that was at the junction of the three drifts where the mineralization passes on into the dike. As no work has been done at this point in the diabase, the nature of the mineralization in the dike is still undetermined.

As in the discovery pocket, the gold found in the later pockets was either with or without gangue minerals. One slab of calcite, shaped like a large dinner plate and about 2 in. thick, contained about 14 oz. of coarse gold. Between the pockets the mineralized material in most cases carried good values in fine gold, mixed throughout the shale and mineralized areas. Practically all of the pockets so far found have been more or less vertical in dip and cutting through the stratification of the sediments. Shale seems to present the best conditions for the formation of pockets, and only finer gold has so far been discovered in the sandstones. Tree roots pulled out of an outcrop at one end of the deposit were found to have a covering of wire gold.

On my last visit, work was going on in the East drift. As the mining was not in a pocket, the ore was separated underground for milling. High-grade, which consisted of the larger pieces of calcite, was sorted out and hauled by Ford truck half a mile to an arrastra. Gold can often be seen with the naked eye in these pieces of calcite, and large speciments are often found at a distance from the pockets. The rest of the muck is hauled to a custom plant, where it is milled on a 50-50 basis. Mr. Jordan stated that the material milled had been running about 1 oz. a ton, and that his ratio of high-grade to mine run has been about one to five. The fineness of the gold, on a value of $20.67 an ounce, is about $15 an ounce.

Drifting has been slow, all being done by hand, and has been expensive, due to the careful handling of all muck because of high-grade and also because of the careful examination given all new faces to discover leads to side pockets or other mineralization in the walls. Outside of gougings along the sides, bottoms, and backs of the drifts, no stoping has been done, all ore coming from development headings. Workings total 230 ft. of drifts and about 65 ft. of open cut.



Sketch of workings in the Ollie Jordan mine, showing where pockets of coarse gold were found

An Addition to Domestic Manganese Reserves

Deposits of Artillery Peak Region, Arizona, of Potential Importance by Reason of Size, Grade and Location — Availability of Cheap Power From Boulder Dam Will Facilitate Exploitation and Beneficiation

Dwight E. Woodbridge

Consulting Engineer, Sellwood Building, Duluth, Minn.

NOTEWORTHY additions to the domestic manganese reserves of the United States through discoveries made in the last ten years have improved this country's position with respect to this essential mineral. Of the newly found deposits none is of greater interest or potential importance than those of the Artillery Peak region, in Mojave County, Ariz. The description of these occurrences in the following text is based on my own investigations over a period of four years, together with those of my associates, and on the examinations and reports on the district made by several well-known independent engineers. Save for limited references to these deposits in both State and Federal Survey bulletins, little or nothing has hitherto appeared in print regarding the discoveries.

The district is in the southern part of Mojave County, adjacent to the Bill Williams River, some 25 miles above its confluence with the Colorado. It is in Townships 11 and 12 N, Ranges 13 and 14 W, and comprises 3,500 to 4,000 acres of manganese-bearing lands, owned by the Arizona Manganese Corporation and the Chapin Exploration Company. Nearly all this tract seems to be underlain by manganese ores. In the area are several prominent outcrops, and recent explorations conducted by the first-named company have disclosed large reserves of a type, nature, and quality that, in my opinion, assure the production of ferromanganese at costs well under the average prices of many years past, the costs being figured as at points of ultimate consumption.

I do not know when or by whom the presence of manganese hereabouts was first noted. The country is difficult to prospect. The topography is exceedingly rough; the better outcrops are hidden in canyons not easy to find; the ores are overlain by basaltic lavas which have weathered into loose and slippery boulders or have been cut down by erosion to the early granites in sharp, blind canyons which are not particularly deep. Except during the rainy seasons there is no water nearer than the Bill Williams, but this river abuts the property. There were no roads and no inhabitants, and the climate is typical of the Colorado desert. But all these drawbacks are common to mining districts at their respective times of discovery. Vegetation of characteristic type occurs.

In the vicinity are several abandoned prospects, where mining for gold, silver, lead, and copper had been attempted. The local prospectors who did this early work often must have seen the broad bands of manganese croppings extending for miles, like strokes from a gigantic paintbrush held in the hand of a Titan. But they had no acquaintance with this mineral, did not know what it was or what it could be used for, and there was no one in all that region whom they could ask about it.

At the time of the intensive search for manganese during and after the War, someone drifted into the country who recognized this material in what he thought was a "blow-out" on top of a little hill, but which in reality was the remains of an upper bed of manganese ore left after the erosion of the surrounding ground. The few thousand tons in sight were mined out; but so crude were the methods employed and so many the difficulties encountered, that little profit was made, in spite of the fact that the ore, as it was mined, averaged better than 40 per cent manganese. I have referred to the roughness of the terrain: it is a fact that there existed, plainly visible to any one who might clamber a mile from this operation, bold outcroppings almost 30 ft. in thickness, on both sides of a narrow canyon and for a total length of nearly 7,000 ft.

Learning of this work, the Chapin Exploration Company sent men into the region to investigate in the spring of 1929. The history of the district may be said to have begun then, for at least one man behind the Chapin company was well acquainted with manganese and knew precisely what it meant. A part of the area was examined and the company took some 2,000 acres, most of it from the Federal Government and the rest from the State. The men sent in by the company, however, also seem to have missed the same broad outcroppings which the earlier operators failed to note. In view of the nature of the area, this oversight is not surprising.

I, too, heard of this manganese-bearing region in 1929, but knew nothing more of it than that it was "in southern Mojave County," and that, although probably extensive, the ore "was low grade and could not be concentrated." I determined to investigate, and in January, 1930, with two Hollywood associates, started from Los Angeles for southern Mojave County. The search was difficult. Our trail grew warmer as the reply to one cautious inquiry after another led us along, until finally we came into the mineralized district. A preliminary inspection left us impressed with the apparent size and possibilities of the deposits.

Coming to the conclusion that not all of the promising areas had been staked, we proceeded to locate lands remaining open for entry. We made many trips to the region and finally located the outcrop that had been overlooked and included it in our holdings. By subsequent relocations, abandonments, and purchases we increased our holding to a connected group of about 2,000 acres, now held by the Arizona Manganese Corporation.

Practically all of the manganese-bearing ground in the district is in all probability now held by one or the other of the two companies mentioned, except for two claims that contained the high-grade ore mined out during and after the War. These are, or up to a short time ago were, still held by the men who took out what good ore these two claims formerly embraced. The holdings of the two companies include such lands as can be developed easily, or in which ores can be found without costly underground exploration of locations where there are no surface indications, and where the possibility of ore is doubtful.

On the east, south, and west the extreme limits of the ore-bearing formation are clearly defined. To the north, overlying lava beds have accumulated to great thicknesses, and there are no erosion canyons disclosing a northerly extension of the beds on lands beyond those now taken.

Two distinct horizontal beds of manganese occur in the district. The lower bed probably covers most of the 4,000 acres held. This ore is low grade. It can be traced for several miles by croppings that average 12 to 20 ft. in thick-

ness. The ores of the lower bed average from 6 to 10 per cent Mn, approximately. Some of the beds are so thinly covered by an overburden of desert soil that a large part of them may be suitable for open-cut mining.

No estimate of tonnage has been made by us. I suppose the mineral ground will run about 2,400 tons per acre-foot. One may assume, I think, that in time these beds of lean ore will be a source of wealth. Today they are a huge reserve, of great value in case of war or cessation of imports from other cause. But no one expects that they can be exploited today.

An upper bed also occurs. It was from the remains of one isolated spot of this bed that the early explorers produced what high-grade ore they shipped. The outcrop which we discovered along the sides of a canyon named by us "Pita," is of this bed. Practically all of the development carried out by the Arizona Manganese Corporation has been done in this bed. The Pita Canyon outcrop extends 3,200 ft. around part of a high mesa, and ceases at its easterly end only where the gradually rising floor of the canyon finally hides it. The bed is probably longer than the croppings indicate. This is called the "Mesa" deposit. Thickness of this horizontal cropping varies little, being nowhere less than 25 ft. and ranging up to a little more than 30 ft. All samples taken from it and from a tunnel driven into it from the canyon side give a weighted average of 15.8 per cent Mn, chiefly in the form of pyrolusite. These openings show no material variation in the thickness of the bed. The only noteworthy change in analysis is that the ore improves somewhat after it passes into ground beyond the point where surface leaching might have been looked for. Thus, assays from the inner portion of the tunnel average slightly better than 20 per cent cent Mn, and the average of the entire tunnel is 16.12 per cent.

This ore will run nearly 4,000 tons to the acre-foot. At a reasonable calculation, this Mesa orebody covers from 165 to possibly as much as 200 acres in an average thickness, as measured by disinterested engineers, of 25 ft. The tonnage is therefore not to be considered casually.

Pita Canyon is a narrow arroyo 200 or 300 ft. deep, cut down to harder granites. Directly across it from the Mesa bed is a similar outcrop, of the same thickness, at the same elevation, but longer than the one opposite, for it extends for several hundred feet along the side of a tributary arroyo that comes into Pita from the north. These croppings, also, are visible to points where the floors of both canyons rise and hide them from view. The length of this cropping is about 3,400 ft. It must be understood that in no case are these croppings actually continuous, for they are in places hidden by the flow of talus from the overlying lavas.

Some engineers who have examined the area question the extent and value of this part of the original Mesa bed. I do not; to my notion the two were once integral parts of a connected whole, and I see no reason to believe that the separation by erosion has changed any of the once existing factors that made them. I consider that there is probably as much ore on the north side of Pita Canyon, and of approximately the same quality, as in the Mesa bed on the south side. But no exploration has been done on the north side, and this alone will prove the facts.

Other portions of the tract contain ore, mostly of problematic extent and value. Exploration of them has been but trifling. There is an undetermined, doubtless comparatively quite small tonnage of an average grade of better than 40 per cent Mn. Parts of the ground contain ore which may be found suitable for battery purposes.

Massive outcrop, 20 ft. thick, of lower low-grade bed of manganese ore, Artillery Peak region, Arizona. Samples taken here assay 8.9 per cent Mn

In the fall of 1935, considerably ahead of the originally scheduled date, the Boulder dam will be so far completed that power will be available over a wide area of the Southwest, including the State of Arizona. This power will be sold at rates hitherto unknown to industries of the country. To Arizona has been allotted 18 per cent of it, a volume far beyond any demand now in sight. The main distribution line across the State will pass close to the Artillery Peak deposits.

Seldom can underground mining be carried on with natural conditions as favorable as on the Mesa bed. Not only is the ore of sufficient thickness for economical breaking and mucking, not only are barren seams or partings lacking in the orebody, but the overlying rock is of so firm a nature that little timbering would seem necessary. The ore is not so friable as to cause losses due to comminution, though it breaks readily to sizes easy to handle. No pumping is necessary and there will be no hoisting, because all ore can be brought to surface through tunnels of easy favorable gradient. No deadwork need be done in development, as adits will be driven on outcrops of commercial ore. Although the country is rough, the haul of ore to mill will be over ground that presents no natural obstacles, and on a slight grade favorable to loads.

Sufficient tests in beneficiation have been completed to indicate that concentration presents no serious major problems. Concentrates assaying approximately 50 per cent manganese, 7.5 per cent silica, 3.5 per cent iron, and a trace of phosphorus have been made without undue losses of ore in tailing. The chief gangue mineral is silica.

Comparisons between these orebodies and others, especially those of Tchiatouri, in the Caucasus, may be of interest. Although estimates of available tonnages, in both localities, may be taken as somewhat uncertain, in my opinion it is probable that there is as much ore in this new district in Arizona as near Tchiatouri. The Russian ore leads in quality by a considerable margin, to be sure. The Russian beds have been mined in such a manner that a large portion of their better ores are no longer available at low production costs. The beds also are thinner and contain intercalated seams of sandstone or of loose and friable arenaceous and calcareous material varying in thickness from an inch or so to a foot and more. Its removal requires care. The product of the mines reaches the western end of the Black Sea after a combined haul of about 110 miles and of not the most inexpensive handling. Shipments of washed ore average nearly 50 per cent manganese, with a comparatively high phosphorus content. At the price of this ore delivered in the United States, duty paid, it is understood there has not been much profit in recent years.

Under present conditions it will cost $1.50 a ton to get the Arizona product freighted to the railway, and no direct rail connection to the district can be expected until a considerable annual tonnage is assured. But I am told that it costs more than this to get Tchiatouri ores to the sea at Poti. As to this I have no recent authentic information. Although ocean freights are low, it is more than 6,000 miles from Poti to Baltimore or Philadelphia. Carefully figured costs indicate that a satisfactory profit can be made out of these Arizona ores, even under the possible tariff reductions which may or may not be contemplated by the Administration. But above and beyond this is the more important fact that by the development of this domestic reserve the self-sufficiency of the United States will be increased in a prime essential of steel metallurgy.

NEWS OF THE INDUSTRY

The beach at Nome where 20,000 disappointed Klondikers and others in 1898-1900 feverishly searched for alluvial gold in the sands

Relief Rushed to Nome, Alaska, Razed by Fire Sept. 17

NOME, Alaska, the scene of one of the most colorful episodes in mining history, was destroyed by fire the morning of Sept. 17. All buildings except the Government wireless station, one hotel, a hospital, a section of the water-front warehouses, and a few residences in the northern part of the city, were a smoking mass of ruins that evening, according to *Associated Press* dispatches. The loss was estimated by city officials at $2,000,000. Of the city's total population of 1,500, about 400 were said to be virtually homeless as a result of the conflagration. The Red Cross and other agencies immediately proceeded to rush relief to the aid of the community.

Origin of the fire was said to have been traced to a spark from a near-by chimney that fell on the roof of the Golden Gate Hotel. The flames leaped from one frame building to another, despite dynamiting of certain structures in an effort to halt the fire's progress. Two Eskimos who lost their lives in the demolition of one of these buildings were the only persons to perish as a result of the catastrophe.

According to advices from Governor John W. Troy soon after the disaster, the homeless required food, clothing, shelter and household utensils. Only food enough was on hand to feed the population for ten days, according to Dr. Rex M. Swartz, Mayor of Nome.

Contributions were taken up throughout California, Washington, and Oregon and in Alaska itself to aid the stricken town. James L. Pieser, vice-chairman of the Red Cross at Washington, D. C., stated that $50,000 had been made available for emergency relief.

Secretary Ickes was said to have indicated that PWA funds would probably be made available for the reconstruction of Nome. Coast Guard cutters in the region have about a year's supply of food on hand, in preparation for ship rescues or other events that would require aid. Three were ordered to Nome.

The Nome that burned was a glamorous one, whose rise had furnished the world with much romance in its thirty-five years. Just south of the Arctic Circle, Nome was only another Far Northern settlement in 1898. The magic of gold from the Klondike and the Yukon soon transformed it into a rip-roaring city of 20,000.

Rex Beach wrote of its gold, Robert W. Service and Jack London of its adventures in the raw. Linked with its romantic name were Alexander Pantages, theatre magnate; "Klondike Kate" and the literary characters Dangerous Dan McGrew, Sam McGee and "The Lady That's Known as Lou."

Many and varied are the reminiscences of Nome that have been recorded by mining men. G. L. Sheldon, who participated in the Nome rush of 1900, states in his recollections of those days, published in the Feb. 1, 1913, issue of *Engineering and Mining Journal*: "There were not many wood houses, only a few stores and saloons, on the main street next the beach. Main Street was soon cut up so that even a dog team would get stuck in the muck and mud. There were no nights; the streets and saloons were always full of people. Nome soon became a city of tents; the first squatter on a lot became the owner.

"For two or more miles along the beach there was the greatest collection of miscellaneous machinery or junk for placer mining that was ever seen together anywhere in the world. It is probable that every kind of patented and unpatented mining machinery ever made for the saving of gold was there; nothing missing; thousands of tons of it, and 99¾ per cent of it worthless."

Union Minière and Mufulira Increasing Production

Union Minière du Haut-Katanga has raised its production rate to 100,000 metric tons of copper per annum, and plans a still further increase soon. It was able to show a small operating profit last year, despite curtailed production and Belgium and the Belgian Congo remaining on the gold basis. Recently the railways have reduced their freight rates, and a readjustment downward of various other charges has brought Union Minière's production cost below even the prevailing gold price of copper. The company reduced its metal stocks substantially last year, and fortunately is in a very comfortable position financially.

Materials for the erection and equipment of the extension of the concentrator of Mufulira Copper Mines, in Northern Rhodesia, are beginning to arrive at the property. The unit of 1,500 tons' daily capacity, completed four years ago, is operating regularly. Additional sections to be erected will bring the daily capacity up to 6,000 tons. A smelter to handle the concentrates is also to be built. The Selkirk shaft, the main hoisting shaft, is being equipped to handle the increased tonnage.

Mining Industry Discounts Future In Action on Dividends

Most Companies Maintain for Third Quarter Rates of Payment in Effect During First Half of Year—Anaconda Copper Strike Settled—Work of Federal Government Mediators Praised

MAINTENANCE of dividends for the third quarter of this year on the part of most of the larger mining companies that made payments for the first and second quarters is perhaps the best evidence available that the improved status of the mining industry continues. Prevailing low prices of the major non-ferrous metals are discouraging, but gold and silver have been of substantial assistance to many a complex-ore producer. Although the immediate outlook for most of the base metals is not particularly encouraging, a gradual betterment of conditions, in connection with probable developments of a similar character in general business, is said to be expected in a number of the more important mining centers.

Mines of the Anaconda Copper Mining Company at Butte, Mont., were reopened almost immediately following the settlement on Sept. 17 of the strike called there on May 8. Local observers of the dispute since its inception highly commend the efforts of R. C. Jacobson and P. W. Chappell, Federal Government mediators, which efforts were largely instrumental in bringing about the settlement.

Status of the proposed zinc code, on Oct. 4, was apparently unchanged. Members of the industry appeared before governmental committees on Sept. 5 and 6, but "all quiet on the zinc front" has been the gist of reports from Washington since then.

A summary follows of the outstanding news events in the various mining districts during the past month.

California

With construction of the new 200-ton mill nearing completion, Empress Mining, operating in the Newtown district, Grass Valley, is preparing for intensive underground mining and development. The mine has been opened to a depth of 1,000 ft., and exploration work on various levels is planned. The mill is typical of the newer flotation plants erected recently in the Grass Valley-Nevada City areas, and employs a set of rolls, an 8 ft. Hardinge ball mill, a Dorr classifier, a six-cell Denver unit and a four-cell Kraut flotation machine, conditioning and thickening tanks, and a 3x4-ft. Oliver filter. Concentrate will be shipped to the Selby smelter. E. C. Jacobs is general manager.

Newmont Mining, controlling the Empire-Star Mines, at Grass Valley; the Murchie, near Nevada City; and the Zeibreight mine, at Emigrant Gap, is reopening the Sultana property, east of Grass Valley, where preliminary work is progressing satisfactorily. At the Zeibreight unit, capacity of the ten-stamp pilot mill is being increased to 150 tons by the installation of a new 7-ft. Hardinge ball mill, a Dorr Model F classifier, a two-compartment Harz jig, an 8x8-ft. Dorr thickener, and a 3x4-ft. Oliver filter. A new Allis-Chalmers double-drum hoist, operating 1½-ton skips, is being installed on the 1,600-ft. level in the Murchie mine.

Carson Hill Gold Mining, at Melones, is mining about 200 tons of ore a day from the Calaveras vein, an open-pit operation, where a ¾-yd. Koehring gasoline shovel is employed for loading ore and 1½-ton Chevrolet trucks are used for hauling it to the mill bin, about a mile distant. John A. Burgess is general superintendent.

Construction of the surface plant at the Big Canyon mine of Mountain Copper, near Shingle Springs, is progressing on schedule. Activities are centered in the erection of the 300-ton flotation mill, a crushing plant, a hoisting, compressor, and change house, repair shops, a laboratory, and storage and office buildings. All buildings are of steel-frame construction. An earth dam, 65 ft. high and 600 ft. long, to impound water for operations, is nearing completion. The collar of the three-compartment shaft has been concreted and erection of the steel headframe and hoisting equipment is in progress. Production is to begin about Jan. 1, 1935.

Following up an approved development plan, Lava Cap Gold Mining has started driving a one-mile tunnel to connect the Central and Banner mines. This will facilitate exploration of territory between the two shafts and simplify movement of Banner ore to the mill, which is treating more than 150 tons of ore a day.

Duleeke Mining, operating the Duleeke mine, near Groveland, has completed a 50-ton flotation mill and is treating about 35 tons of ore a day.

West America Consolidated Gold Mines is sinking the shaft at the Amador Star mine to the 1,000-ft. level, preparatory to development work to be undertaken on the lower levels. The company has recently acquired the nearby Bay State property, idle for 30 years, and is dewatering and equipping the 1,065-ft. shaft for early operation. Power is furnished by a 115-hp. diesel engine. Plans are also maturing to increase the capacity of the 75-ton Amador Star mill to 300 tons and to connect the Bay State and Amador Star properties with a wire-rope tramway. Arthur Hamburger is president of the company and W. F. Waldner is directing operations.

Collins Pacific Company has acquired a lease and option on Grass Valley Extension, consisting of 800 acres adjoining the Empress mine and extending for a mile and a half toward the Idaho Maryland. The Collins company intends to develop the property in the near future by sinking a 500-ft.

In the Ouray district of Colorado, where extensive rehabilitation operations are in progress. The Revenue tunnel, the portal of which may be seen in the left foreground, is being reopened by Revenue Mines, Ltd. Cleaning-up operations in the tunnel have reached the Virginius station.

shaft and by other development work. The vein across this property is said to be well defined, averaging 2 to 7 ft. in width. A 280-ft. shaft, sunk in the early 'eighties, exists on the property.

Colorado

Revenue Mines, Ltd., has been organized for the purpose of opening up the Revenue mine, near Ouray. Frank Eichelberger, of Field, B. C., is president, H. B. Van Sinderen, of C. Tennant Sons & Company, of New York, vice-president. J. T. Shimmin, formerly engineer in charge of the mining department of Southwestern Engineering Corporation, is manager of Colorado operations.

Twenty-two men are employed at the mine cleaning up and reopening the old Revenue tunnel, cleaning up old workings, and retimbering. At present the Revenue tunnel is opened to the Virginius station; the North Terrible drift is open to the breast, which is 1,202 ft. north from the Revenue tunnel; and the Cumberland drift is opened and cleaned for a distance of 420 ft. C. E. Tonry, formerly chief mining engineer at the Smuggler-Union, has been supervising the work at the Revenue mine.

The same group, operating under the name of the San Juan Metals Corporation, has taken over the Gold Run Mining & Milling Company property at Telluride. A modern regrinding and flotation plant on the property is treating 400 tons of tailing reclaimed from operations of the old Smuggler-Union, Liberty Bell, Tomboy, and Cimarron properties. S. E. Hollister, former metallurgical engineer of the Southwestern Engineering Corporation, is superintendent.

The North American Mining Corporation, organized under the laws of the State of New Jersey, is the holding company of both Revenue Mines and San Juan Metals and operates under the same board of directors and management.

A combined flotation and cyanidation mill of 100 tons' daily capacity has just been erected by Summitville Consolidated Mines, at Summitville. The contractor was Edward L. Sweeney.

Montana

An agreement to settle the strike which was called on May 8 against the Anaconda Copper Mining Company was reached Sept. 13. Terms of the settlement were agreed to by officials of the Anaconda company and a committee of officials representing strikers at Butte, Anaconda, and Great Falls. Terms were submitted to general vote of union members involved in the strike on Sept. 17, which vote resulted in a better than two to one approval of the agreement.

Terms of the settlement, presented on pages 436 and 437, grant the closed shop but not the check-off system. Working conditions, such as the contract system and one-man drilling, will remain the same as in effect on Jan. 1 of this year. A wage of $4.75 a shift to miners is guaranteed for a period of six months. Thereafter a sliding scale of wages based on the price of copper applies.

Local observers of the dispute since its inception highly commend the efforts of R. C. Jacobson and P. W. Chappell, Federal Government mediators, who were largely instrumental in effecting the settlement. Operations at the company's mines and plants were resumed immediately following settlement of the strike.

Arizona

A fire on Sept. 13 destroyed the milling plant of Katherine Gold Mining, situated on the Colorado River about 30 miles west of Kingman. Structures lost in the conflagration included the mill, precipitating plant, sampler, gallows frame, loading platforms, and the power house. Total property damage is estimated at $150,000. Mill operations began Sept. 10, 1933, at a rate of about 40 tons of ore a day, which ore was from the Tyro, Arabian, Roadside, and Frisco mines. Capacity of the plant had been increased to 150 tons during the past three months. A power line to the property, to increase capacity to 300 tons, was erected, and this power was to have been available on Sept. 14. Plans have been announced by Earl F. Nieman, manager of the Gold Standard Mines Company, operators of the mill, for the rebuilding of the plant. Expectations are that operations will be resumed in about ninety days.

Shattuck-Denn Mining, at Bisbee, has been granted a sales allocation of 100 tons of copper a month by the Code Authority. The company desires an outlet for about 2,000 tons of ore a month produced during the development of a large body of ore that was disclosed by drilling in 1930. The ore, to be sent to the El Paso smelter of American Smelting & Refining, will be used in fluxing the siliceous gold and silver ores being received there in increasing amounts.

Lost Basin Placers, along the Colorado River near Pierce's Ferry, recently tested some high-grade gravel, according to Frank P. Baldi, manager. Low water and high atmospheric temperatures caused a cessation of operations during the summer, but they will probably be resumed this month.

Sale of the Columbia gold mine, near Payson, to Eastern interests has been announced by J. M. Shiner, of Globe, who recently sold the West claims in the same district.

A new 50-ton selective flotation plant will be completed this month at the Keystone mine, Mineral Park, near Chloride. At the near-by Pilgrim mine, the mill being erected by Pioneer Mining is expected to start early this month.

The Austerlitz mine, first worked by the Jesuits from Tumacacori Mission, is being sampled by the Eagle-Picher Lead, operators of the Montana mine, in the same district, at Ruby.

Arizona Consolidated Mining, at Humboldt, is milling 45 tons a day of gold-silver ore from the Union and Jessie mines. The shaft at the Jessie property is being sunk to the 300 level, and the company is endeavoring to develop additional water to supply a larger mill.

Magma Copper, of Superior, has taken an option on the Jupiter and other claims, near Tucson, and started development work.

International Mining & Milling is installing shaft-sinking equipment at the Golden Hawk mine, near Salome.

Golden Turkey Mining, at Cordes, is shipping concentrate from the new flotation plant to the El Paso smelter.

Utah

Bids will be received until Oct. 18 by the United States Department of Reclamation office, Federal Building, Salt Lake City, for the driving of a 7,200-ft. tunnel in the Ephraim division of the Sanpete County PWA project. Estimated cost of the project is $173,000. Size of the bore will be 5½x7 ft.

The quarterly dividend rate of Silver King Coalition Mines was reduced for the third quarter from 15c. to 10c. a share. The disbursement, aggregating $122,046.70, will bring the grand total paid by the properties of the company up to $26,161,398. Increased costs, including wages, and lower prices for zinc and lead, caused the reduction of the dividend.

Production has been resumed at the American Flag property of Park City Development, at Park City. The plant, destroyed recently by fire, has been replaced.

A new Ingersoll-Rand compressor is to be installed at the portal of the main tunnel of Park City Consolidated Mines, at Park City. The new compressor, with a capacity of 625 cu.ft. a minute, with the old one now in use, will double the capacity of the plant and allow the company to maintain its output at 180 tons of ore daily, attained during September. Production during August averaged 132 tons daily. An electric hoist has been installed at the collar of 403 winze, in the East Crescent fissure. Production is coming from this fissure and the Roosevelt and Crescent fissures.

Tintic Standard directors voted a 2½c. increase in the dividend of the company for the third quarter, increasing the dividend rate to 10c. a share. Eureka Standard declared the usual 3c. dividend. Tintic Standard's disbursement, totaling $115,331.50, brings its grand total to $15,036,211, and that of Eureka Standard, amounting to

$44,987.70, brings its grand total up to $764,790.

Sinking of the Tintic Prince shaft in the north end of the district has reached a depth below 110 ft. The shaft has been started in a tunnel 400 ft. from the portal.

Leasing is to be resumed in the Gemini property of Chief Consolidated Mining's holdings. Rehabilitation of the surface plant is under way, with George H. Ryan and Stafford Robertson in charge.

High-grade silver ore has been cut on the 1,000 level of the Apex Standard property of Chief Consolidated Mining, near Eureka.

The Annie Laurie mine and mill, 8 miles southwest of Marysvale, is being operated by B. F. Bauer, owner, who reports that 50 men are employed in the mine and mill. Operations are being concentrated on the upper workings of the mine.

Michigan

Progress toward more efficient use of Michigan's mineral resources has marked the first three months of the FERA-supported research program at the Michigan College of Mining and Technology, directors of the program report. Five major metallurgical projects and investigations are on or ahead of schedule and have yielded encouraging results.

Much attention is given to the beneficiation of iron ore, in which two possible processes are being thoroughly investigated. Work on the gravity-concentration method involves a study of the structure and texture of the different iron formations of the Upper Peninsula from the standpoint of ore-dressing possibilities, study of the theory and practical efficiency of laboratory tests, and the designing and improving of ore-dressing apparatus.

The commercial use of copper pipe fittings has been brought nearer during the past three months as a result of studies by the mechanical engineering department under the FERA grant. Previous to June of this year, Michigan Tech investigators had produced practical designs, and last summer they reduced the time necessary for pressing out relatively low-cost copper fittings.

Nevada

Until the last week in September, when storms brought some measure of relief, mills in a number of Nevada mining districts were compelled to suspend or to curtail operations materially, as springs failed and the water table receded in districts where water had been drawn from mine workings. At Midas, in the Gold Circle district, two wells drilled by East Standard Mining with an 8-in. Keystone drill provided some water, enabling H. S. Joseph, manager, to run the 50-ton amalgamating mill on one shift. At Tonopah, the 250-ton cyanide mill of the West End Consolidated, lately provided with a flotation unit to treat ore from the New Deal property two miles south, was closed down for lack of water and, in part, because of the low grade of the ore. The Round Mountain cyanide mill of Nevada Porphyry Gold has been limited to about half-time operation, with complete suspension of gravel washing, and several smaller mills have closed down. The Comstock district, with mills at Virginia City and Silver City, has been the only Nevada district with adequate water supply and unaffected by the drought. All attempts at placer mining, excepting near Osceola, close to the Utah boundary, have been abandoned and must await the winter storms.

A series of 200-ton test runs is being made on ore from the Gold Ace mine of the Gibraltar Mines in that company's 50-ton flotation mill at Carrara, a mile distant in the southern part of Nye County, under a lease and option of purchase taken recently by Mark L. Requa and associates, of San Francisco. The mine produced some gold ore of exceedingly high grade seven years ago, and subsequent work is said to have developed a large tonnage of highly oxidized mill-grade ore in a bedded deposit 300 ft. in thickness. If present tests give satisfactory results, the purchasers, according to reports, will provide a large-capacity cyanide mill at the mine.

A 60-ton cyanide mill lately completed on the old Hartford mine, in Gold Canyon, above Silver City, is reported by officers of Hartford Mining to be operating with complete success on ore of good grade, the metal content of which is nearly all gold. The mine, an early-day producer, was bought last year by George Drysdale, veteran Comstock mine manager, in association with Harold Hansen and Edward Gunderson, of San Francisco. The mill was constructed under contract by the Western Machinery Company, whose construction engineer, Roy Marcellus, designed and built the mill.

Last week the No. 2 ball mill in the Arizona Comstock Corporation's flotation mill was put in commission, raising daily mill feed from 220 tons to about 330 tons. Ore is drawn from a huge open cut extending diagonally across the outcrop of the Comstock lode on the Hale & Norcross mine. The outcrop here is over 300 ft. wide, a wall of ore rising at the west 120 ft. above the floor of the cut. Little powder is used, the ore being broken and loaded by power shovel to 5-ton trucks and delivered by less than a 2,000-ft. haul to the coarse-ore bins above the mill. W. J. Loring, president and managing director, reports that since the open-cut operation was started, May 3, and up to Aug. 5, a total of 15,766 tons of ore was trucked to the mill. Trucks also moved 9,123 tons of waste, representing 36 per cent of the tonnage moved. Total costs in July, including every item of expense excepting depreciation and depletion, were $1.83 per ton, including a fraction over 50c. per ton for mining, loading, and delivering ore to the mill. During the three months' period, concentrate to the value of $51,595 was shipped to the smelter at Selby, Calif. Addition to the mill of a Simpson pneumatic flotation machine has enhanced metal recovery, but flotation at best gives indifferent results in treating the highly oxidized surface ore in which the gold is largely free, but some of it coarse and "rusty." All flotation tailing has been impounded for treatment in the cyanide plant, under construction below the flotation mill. Another cyanide unit will treat the concentrate, now shipped by truck every five days to the smelter. The working force, for some time averaging 63, is being increased.

Most notable undertaking of its kind in Nevada, the tunnel development project of Como Mines, 12 miles air-line south of the Comstock district, has reached one of its first two objectives in the northeast lateral, which has entered and is following the Rapidan vein. The east lateral, surveys indicate, will enter the Como vein within less than 50 ft. The main tunnel, 3,500 ft. long and 8x8 ft. in cross-section, was started in the early 'nineties by Col. John Boyle, father of the late Governor Emmett Boyle and a veteran Comstock operator. From the end of the tunnel, the two 8x8-ft. laterals have been driven to explore several large veins from 550 to 650 ft. in vertical depth and 300 ft. below shaft workings that have blocked a large tonnage of high-grade mill ore. These veins, fissures in andesite, range in width from 6 to 50 ft. At the point penetrated by the tunnel, the Rapidan vein shows a width of 22 ft. of quartz ore. At a point 1,600 ft. from the point at which the laterals branch, a raise to connect with the Rapidan incline shaft is up over 120 ft. on the footwall, and the heading has been advanced about 270 ft. beyond the raise. Near the present breast a deep winze is to be sunk to explore below the water level, the ore of the Rapidan vein being largely oxidized to this depth, whereas that of the Como is a solid sulphide below the 125-ft. level. About 1,500 ft. from its portal, the main adit passes through the Mount Como vein, 50 ft. wide. The laterals will open at depth four other large veins in which pay ore has been developed. The three headings, including the incline raise, have been advanced 30 to 35 ft. per day with equipment that includes trains of 3-ton side-dump cars, drawn by storage-battery locomotives; specially designed trucks or "jumbos" upon which drills are mounted; and Hoar mucking machines. Mine workings supply an adequate flow of water for a large-capacity

Surface plant of Superior Gold Mines, Inc., 14 miles west of Modena, Utah. Capacity of the flotation plant was recently increased to handle 130 tons of ore daily. Other new equipment installed includes a 150-hp. diesel engine and a 5x6-ft. ball mill.

mill. Charles Oster is president and manager, William Mader mine superintendent, and Clark Stoddard engineer. According to current reports, Archer E. Wheeler, engineer and metallurgist, of New York, and lately reported to have been in Rhodesia, will be commissioned to design a mill for the Como Mines, probably of 300 tons' daily capacity.

Final payment has been made by New York interests for the Buck & Charley mine, at Lower Rochester, the only mine in the Rochester district, Pershing County, to develop high-grade gold-silver ore in the sulphide zone. The mine has produced a substantial tonnage of shipping ore above the adit level, and late work has developed high-grade ore in three veins to a depth of 360 ft. below this elevation. Rochester Plymouth Mines has been organized to acquire and operate the mine, with T. R. Cowell president and Charles Oster vice-president and manager. A central three-compartment working shaft is being opened by raising from the bottom level to the surface, and a 40-ton flotation unit will be completed by the time the shaft is finished. The veins are described as contact deposits between rhyolite and limestone, from 6 to 16 ft. wide and of marked uniformity in grade.

On the 1,600-ft. level of the Union shaft, near the north end of the Comstock lode, a crosscut has been extended west 1,200 ft. to explore for the "base" vein, opened many years ago on the 2,000-ft. level, about 300 ft. below the elevation of the Sutro tunnel and now under water. This vein, believed to be part of the Sierra Nevada branch of the lode striking northeast 40 deg. from the course of the main lode, was said to show a substantial width of ore of good grade, but containing lead and zinc in quantity precluding its treatment by the pan-amalgamation process of the period. The ore, a heavy sulphide, investigators contend, can be treated with success by flotation.

Undertaking the reopening of early-day workings in Cedar Hill at the northern extremity of the Comstock lode, Sierra Nevada, Ltd., has installed a compressor at the portal of the Reilly tunnel, next to the lowest of seven tunnels driven into the domelike hill at various times. Old records indicate a considerable output of highly profitable ore from this area in the 'eighties, and a surface glory hole is said to contain ore that can be milled with profit in a local plant. The adit has been reopened to a point within 100 ft. of a raise connecting with the Kenosha tunnel, 150 ft. higher in elevation. Arthur Thomas, of Salt Lake City, is president and Gibson Berry engineer of the company.

Early completion of a 50-ton cyanide mill at the Buckskin-National mine, in the northern part of Humboldt County, was forecast by officers of Nevada Lucky Tiger Mines, subsidiary of Lucky Tiger-Combination. Equipment of the former flotation mill has been scrapped, as recovery by that process was unsatisfactory. The mill and camp, high on the northeast shoulder of the range, are virtually isolated from October to June by deep snow, and a deep-level cross-cut tunnel will probably be driven later from the west side of the ridge, about 4,200 ft. long, giving additional depth of 1,000 ft. or more below the present adit, which cuts three parallel fissures in a rhyolite laccolith.

A long-term lease on the Belmont mine, at Tonopah, has been granted to H. D. Budelman and associates connected with West End Consolidated in the same district. The main shaft has been reconditioned to the 1,200-ft. level.

Mother Lode Miners Declare Strike

Four hundred miners employed in four Mother Lode gold mines, in California, voted on Sept. 30 to declare a strike effective Oct. 4. Properties involved are the Argonaut and Kennedy, at Jackson; Central Eureka, at Sutter Creek; and Little Amador, at Amador City. The vote was taken by Mother Lode Miners' Union No. 43. The increase in the price of gold from $20.67 to $35 an ounce to said to be back of the strike.

Mexican Mining Industry Progressing Toward Recovery

The Mexican mining industry is progressing favorably along the road to recovery after last year's depression, which was the worst in its history, President Abelardo L. Rodriguez averred in his annual message, covering national activities from Sept. 1, 1933, to Aug. 31, 1934, rendered at the recent opening session of the 36th Federal Congress.

Highlights of developments in the mining industry mentioned in the presidential message were: Improvement in metal prices, principally gold and silver; wage increases; development of new exploitation and exploration works; small-scale miners are establishing plants; practically all companies that discontinued operations have resumed work; applications for rights to mining lands filed with mining agencies averaged 733 monthly during the period of the report; from January to May of this year, lead production increased by 50 per cent; zinc by 60 per cent; copper by 10 per cent, and antimony by 80 per cent; white arsenic output was about double that in the same period of 1933. but output of mercury and graphite was about unchanged.

Ore shipments have been started from the Escondida mine, Quiriego, Sonora, operated by F. A. Byerly and A. B. Wallmark. . . . T. P. Brinegar has resumed working the La Bessie Way and La Cacharama mining properties, near Alamos, Sonora. . . . J. H. Weiter has leased from Balsas Valley Mining for ten years the Mina Grande, Porfirio Diaz, Cruz del Sur, and Haines "E" properties, in the Balsas Valley, Guerrero, and proposes to install a 500-ton mill. The Mina Grande group has been idle since 1910. . . . W. E. Brock and Ernest Stein, both of Durango City, Durango, have begun operations in the old Sacrificio silver-copper district, in the Sierra de la Silla mountains.

Mining Congress Weighs New Deal At San Francisco Meeting

Secretary Callbreath Calls Some of the Administration's Present Policies Antagonistic to Mining—Dr. Finch, New Director of Bureau of Mines, Urges Maintenance of All Experiment Stations

THE individualistic character of Western mining men and their independence of thought found constant expression in their criticism and dislike for many features of the New Deal in the course of the annual convention of the Western Division of the American Mining Congress, held at San Francisco Sept. 24-29. J. F. Callbreath, secretary of the American Mining Congress, declared, however, that the organization is not fighting the Administration, as an Administration, since the congress is non-partisan. "But we do criticize," he said, "certain acts which we believe inimical to the public interest and which we believe retard recovery. The only politics we recognize are politics of mining. When we cease to criticize, we cease to be an influence in our country's industry. Earlier, we supported the Administration. Now, we feel that some of the present policies are antagonistic to the mining industry."

Members of the congress and mining men in general attended the meeting in large numbers, and considerable public interest characterized the various sessions. An attractive exhibit of manufacturers' products applicable to the mining industry featured the meeting. W. S. Boyd, national chairman, Western Division, opened the first session. W. Mont Ferry gave the first paper, entitled "Rehabilitation of Non-Ferrous Metals." He commented upon the economic importance of the non-ferrous metals and instanced the situation in Utah, where he said 47 per cent of the people are directly dependent upon the mining industry for their livelihood. According to estimates, 1,433,000 of the 18,000,000 population of the eleven Western states gained their living from the mining industry in 1930, and in two years this mining population had shrunk to some 416,000.

Dynamically, if not convincingly, Key Pittman, Senator from Nevada, teased out the skein of silver legislation and made clear to his interested audience the various steps taken by Congress and the President in their efforts to restore the money functions of the white metal. The Administration, he said, is acting slowly in its purchases so as to prevent too sudden an appreciation in the price of silver. In his opinion there would be little disturbance and no injury to foreign trade by the slow appreciation of the world silver price. He commented upon the relation of gold to silver and stated that if carried to its logical conclusion the devaluation of the dollar would result in $41.34 per ounce for gold, and that when this price had been reached the revaluation of the silver dollar would be a natural consequence.

J. F. McCarthy, of the Hecla Mining Company, introduced Dean Frank Probert, the first speaker on Tuesday. Dean Probert discussed the "Place of Minerals in Industrial Life." He brought out the significant advances that marked the development of the mining industry and indicated its importance in modern civilization. Fervently he criticized reforms that he labeled distinctly socialistic and said, "It is to be hoped the reforms will not destroy every vestige of private initiative and capitalistic economy. Otherwise we may find ourselves condemned eternally to roll the stone of forlorn hope up the steps of despair. Recovery and reform do not work well together." He summarized by saying that much that was being attempted was tragically futile and enormously costly. "Labor," he said, "rides in the saddle today and it has a tight grip upon the reins of government." He deprecated government encroachment upon private enterprise as well as the spectre of state control of business.

Charles H. Segerstrom, of the Carson Hill Mining Company, took as his subject "The Problems of the Gold Mining Industry." He commented upon the real difficulty of finding a commercial gold mine and the obstacles in the way of its financing. Charles A. Chase, of the Shenandoah-Dives Mining Company, presided on Wednesday and introduced Oscar A. Glaeser, who read a thoughtful paper on the general principles of accident prevention and then discussed the problem of safety first as applied to gold mining.

M. G. Hansen, of the Anglo American Mining Corporation, gave an interesting paper on "Diamond-Drill Practice." He was followed by Dr. John Wellington Finch, Director of the United States Bureau of Mines, who took as his subject "Planning for the Future With the United States Bureau of Mines." Dr. Finch said, "As most of my experience has been in mining I prefer to have you think of me as a mining man rather than as a professor, as the latter occupation is already pretty well represented at Washington. I also prefer to study the Bureau from a mining man's viewpoint." He stated that the Bureau was intended to be a service organization at Washington for the mining people. He mentioned the United States Geological Survey as also a service organization for the mining industry. He pointed out that the Bureau had no regulatory function and was not a bureaucratic organization and would not have that character as long as he was at the head of it. He complimented his predecessor on holding the Bureau together in the face of adverse circumstances and the lack of money. He dilated upon this lack of financial support. The Bureau is now back in the Department of the Interior in a friendly atmosphere and has the interested cooperation of the Secretary of the Interior. He said, "The President has been developing a more and more interested attitude toward the industry." He commented upon the health and safety program, explosives research, mineral technology, and economic research in minerals. He said, "I want to urge you to maintain the sentiment for the maintenance of all of our stations. The President has ordered studies to be made of the mineral industry and wishes to help it."

At the Tuesday round-table discussion the subject was "The National Labor Board." Mining executives brought out numerous points and criticism of Section 7a and its interpretation by the Labor Board. The lack of industrial experience of the members of the board and its decided leaning toward labor were commented upon. Charges were made that the board lacked impartiality; that it was trying to force reluctant men to join unions; that there was an utter disregard for the right of stockholders or consideration for invested capital; that its actions were fostering radicalism, and that it was an instrument for the intimidation of the employer.

At the Wednesday round-table discussion centered upon unemployment insurance and workmen's compensation. The imminence of federal legislation upon the subject of unemployment insurance was stressed and various state systems of old-age pensions were described. In particular, the costly workmen's compensation in California was brought before the Mining Congress for its aid in securing some amelioration.

On Thursday James A. Emery, general counsel, National Association of Manufacturers, spoke upon the acute difficulties arising in industry over the interpretation placed upon Section 7a of the NRA codes by the National Labor Board. This recent ruling that a majority of employees controls collective bargaining in industry, and that minorities or individuals have no voice, he pointed out, upsets the former rulings of the NRA administration. Following the speaker, Tasker L. Oddie discussed some of the monetary aspects of the gold problem.

Paul Shoup, vice-chairman of the

Southern Pacific Company, impressively discussed industry's responsibility. "The important question," he said, "is how far is the government going to go with the freedom of man. We will not reach any real solution of our present difficulties until the great majority of our people are happily employed and have confidence in that employment." He pointed out that nothing is fixed in industry. He indicated how industry had raised the standard of living; how it pays all taxes; that the government's power to tax is unlimited, but the ability to collect is very limited. He contrasted the nation's wealth and income during various years, and showed that the tax load of 1933 is about 5 per cent of the entire wealth of the country. He insisted that profit is essential for the growth of industry, and that industry should combat all that is unsound in present governmental plans and that taxes must be reduced.

At the round-table discussion of NRA in the afternoon, R. C. Allen discussed codes and industry. He admitted that there had not been a fair distribution of the income of the country, but stated that the NRA did not hold the answer to this problem. He commented upon the overdevelopment of production facilities and the competition when there was insufficient business to go round. Hedging on labor is the first and most direct way to handle such a situation, and in this he admitted that labor has a legitimate objection. He said, "I think that we shall not return to peace in the industrial world until there is some better accommodation in that situation." He expressed doubt as to attainment of the objectives of the NRA, pointing out the impossibility of fixing a minimum wage and the still greater difficulties arising from the attempt to fix hours and days of work. He asked, "Is anyone of us so wise that he can foresee the demands of 130 millions of people; can anyone determine the amounts of anything that may be demanded? Least of all a few men gathered together in a room in Washington. Is it possible to have a planned economy contemplated in these codes? Experiments in planned economy have been made for us. That is the idea of Russian communism. That system is the logical outcome. I do not believe that communism is going to be involved in our country." The difficulty of finding a stopping place to any system of confiscation was clearly shown by the speaker.

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Diamond Company to Mine Gold

Tanganyika Diamonds has obtained options on three gold-mining properties in the Musoma district of Tanganyika Territory. J. T. Milligan, formerly consulting engineer of the Anglo-French company, has been appointed general manager of the gold properties.

Five bars of Ontario gold bullion, with an aggregate value of $112,000, about to be placed in individual, specially constructed boxes for shipment to the government mint at Ottawa. Estimates of the total value of 1934 gold production in Canada are currently placed at $100,000,000

Canadian Labor Legislation Hailed As Outstanding Achievement

Dominion's First "Mining House" Established in Montreal—Major Rush Develops Along the Sturgeon River, West of Little Long Lac, in Ontario—Cariboo Gold Quartz Increasing Output

KNOWN in its earlier stages as the Arcand Bill, after its sponsor, the Minister of Labor, the Collective Labor Agreements Extension Act of Quebec continues to be the outstanding achievement of the Canadian legislative bodies as regards the improvement of the basic conditions of industry. It provides for the negotiation of agreements as to hours of labor and rates of wages. These negotiations are conducted by responsible bodies of employers on the one hand and of employees on the other, and the influence of extremists on both sides is either excluded by a natural means or so modified as to be harmless.

A number of important industries are now operating under the act, including the construction industry and various manufacturing industries. Enforcement of agreements is in the hands of committees appointed jointly by employers and employees of each industry, which have power to investigate and adjudicate infractions and disputes privately, or can have recourse to the courts when necessary. Up to the present almost all the disputes and infractions have been dealt with effectively without recourse to the courts. The strength of this measure appears to lie in the fact that it provides for the self-regulation of each of the industries, both the terms of the agreement in each instance and its enforcement being strictly dependent upon the members of the industry, without interference from others but with proper safeguards for the public interest. A number of the other provinces have emulated the lead given by Quebec, the bill for Ontario, as drafted at present, being in all essentials the same as the Quebec act.

Canada's first "mining house," to use that term in the London sense, has recently taken shape in Montreal. Nesbitt, Thomson & Company, which has been prominent for twenty years as the promoter and manager of a number of public utilities, particularly hydro-electric power, have now definitely entered the mining field. After purchasing substantial blocks of shares in Central Patricia and Pickle-Crow gold mines, in the District of Patricia, the firm has concluded an affiliation with M. J. O'Brien, Ltd. The present agreement with Nesbitt-Thomson has as its immediate object the further development of the O'Brien Cadillac gold mine, in northwestern Quebec.

Quebec

Substantial activity prevails in Beauchastel Township, adjoining Rouyn Township on the west. The Aldermac mine is operating steadily at the rate of 300 tons a day, shipping its pyrite concentrate to Lake ports and its copper

concentrate to the Noranda smelter. At the Lake Fortune property, scene of the first gold discovery in the Rouyn district 25 years ago, an electrically driven mining plant has been installed and the sinking of a vertical shaft to a depth of 500 ft. is under way. At least 1,000 ft. of drifting will be done at the various levels to explore thoroughly the deposits already outlined by shallow workings and drilling. A 200-ton mill is under construction at the Arntfield mine. On the adjoining Francoeur property, a shaft, inclined at 50 deg., has been sunk 300 ft., and the exploration of the extensive gold-bearing zone, which is a part of the same zone in which the Arntfield ore has been developed, is under way.

The extension of Canada Northern Power's transmission line 60 miles eastward from Rouyn along the gold belt has already brought the company five customers—namely, O'Brien Cadillac, Greene-Stabell, Sullivan, Lamaque, and Thompson Cadillac, of which the first three are producing gold steadily. Siscoe and Canadian Malartic are negotiating for power. Provision of an abundance of power has given a distinct stimulus to the development of this part of the gold belt.

Ontario

The season's major staking rush has developed along the Sturgeon River, 30 to 50 miles west of Little Long Lac and from 10 to 15 miles north of the Long-lac-Port Arthur branch of the Canadian National Railways. A large part of Ontario's numerous and competent corps of prospectors is at work in this extensive locality. Though no discovery has as yet been developed sufficiently to permit of gaging its merits, the finds are so numerous and some of them are so substantial on the surface that a large number of experienced mining engineers have acquired holdings in the area for their companies.

Among the several properties being vigorously developed in the Little Long Lac sector of this belt, the McLeod-Cockshutt is at present the closest to repeating the good fortune of the Little Long Lac mine. In the Dik Dik locality, 15 miles to the west, where open cuts yielded last spring several carload shipments of high-grade ore, operations have been resumed on the 150-ft. level. Drifting for 150 ft. on that level has given good results, and the shaft is being extended to a depth of 300 ft. The oreshoot here is small and rich.

At Red Lake, following the recent successful results on the MacKenzie property, where a 125-ton mill will be ready for operation by the end of the year, a dozen or more properties are being actively developed. N. A. Timmins has optioned the Cochenour-Willans claims at the east end of the lake, where an unusually extensive area of mineralized rock has shown, at surface, values that may be payable. The hydro-electric power plant at Ear Falls, which develops at present 5,000 hp. to serve this area, is to be expanded by the addition of another unit.

The Teck-Hughes mine, in an interim report, announces a reduced dividend and a cut in mill tonnage from 1,300 to 1,000 tons. This follows disappointing results in the lower levels of the mine, where both the volume and the grade of the ore have diminished. The mine has been exploited more rapidly than any other large gold mine in the country, and a substantial cash reserve has been built up. At the Lamaque mine, in Quebec, controlled by Teck-Hughes, the aggressive campaign of development has now outlined what may be a large mine, in spite of rather erratic ore occurrences.

British Columbia

With two reports conveying different recommendations, directors of Cariboo Gold Quartz Mines have decided to carry on with their policy of increasing production upon a basis of indications rather than of proven ore. The two reports in question are those of Ira B. Joralemon and Messrs. McCarthy and Binns, of London. The latter report was made following an independent investigation by Norman J. Wynne and has been received and published recently. According to the terms of this report the property is still to be regarded in the light of a prospect, although of considerable promise.

Developments in the Sheep Creek Camp continue to afford encouragement to the belief that this area will figure prominently in the gold production of the province in the near future. At the Reno mine development on the 6th level has shown that the western oreshoot shows improvement, both in regard to extent and grade, as compared with the ore which was opened up on the levels above. The shaft which is being sunk in this section of the mine is being pushed ahead as rapidly as possible, although during recent weeks some interruption of operation has resulted, owing to water shortage and forest fire hazard. The Kootenay Belle mill is expected to be in operation this month. Recent developments in the mine have been encouraging.

Satisfactory progress is also reported at the Gold Belt property, where the crosscut is being advanced to cut the "A" vein, from which good ore has been taken in surface workings. The "C" and "D" veins are continuing to open up well with development. Perhaps the feature of greatest encouragement in this camp is in relation to the Queen mine, which is being operated by Sheep Creek Gold Mines. The recent work of development on the 7th level, which followed recommendations made by Col. H. H. Yuill early in the year, has resulted in proving the continuation of two veins of an average width of 6 ft. each over a distance of about 360 ft.

Manitoba

Construction of the Gods Lake power development, with an initial capacity of 1,200 hp., has started, with the aid of materials and equipment taken in by airplane. Preparations have been made to assemble the bulk of the materials for the power plant and a 200-ton mill at Mileage 286 on the Hudson Bay Branch of the Canadian National Railways for shipment by winter road to Gods Lake, a distance of 120 miles. Meantime, the mine continues to develop a substantial volume of ore of good grade.

Unique washing plant of the Charleson Mining Company, near Hibbing, Minn. The sky is the roof, with "dog houses" built over electrical equipment for rain protection. Ore is delivered from near-by "exhausted" pits by large trucks equipped with a double low gear to negotiate the unusually steep grades traversed.

NEWS FROM WASHINGTON

POLITICS continues the major industry of Washington. This distorts even mining news and mining economics. One who views national problems, therefore, must wear appropriate lenses to correct for the economic astigmatism which election year aggravates.

The President, returning from his Hyde Park sojourn, took his first opportunity to offer what seems to have been designed as a deliberate affront to the United States Chamber of Commerce in his brusk refusal to reply to its questionnaire as to intended policies. Keen Washington observers interpret this act significantly. They believe that the President has turned definitely more to the Left, apparently heartened greatly by Maine election and Massachusetts Democratic primary results. These developments, wiseacres say, greatly strengthen the New Deal in its more drastic phases and in its assurance that all wanted legislation will be delivered by Congress next winter in accordance with Presidential request.

Business men with jitters, and many of them are seen or heard from by letter in Washington, find in recent political news only one comforting episode. This is the unusual exhibit of Senator Borah, proverbial soloist, joining in the harmony of The American Liberty League. His sentence commending that advocate of property rights, which bids fair to become classic, is oft repeated in its original language: "The power which closes the door of opportunity to me in the business world leaves me cold to all their panegyrics about liberty."

Mining Loans

At the end of September nearly 5,000 requests for application blanks had been received from concerns and individuals interested in obtaining a mining loan under the Industrial Loans Act. Due to the fact that the application form had to be prepared with great care, the blanks were not available for distribution until the first week of August. This accounts for the fact that at the end of August only 47 formal applications had been filed.

It is believed that the slowness with which applications are reaching Washington is due to the fact that many of those interested do not clearly understand that the deposit covering the cost of examination does not have to be made at the time the application is filed. It is explained at the offices of the Reconstruction Finance Corporation that no deposit of any kind is required until after the application has been examined and accepted and found to be adequate in all particulars. If the property seems to be eligible it then is referred to an engineer of the locality, so that the statements made by the applicant may be checked. It is at that stage of the negotiations that the deposit must be made to cover the actual cost of the examination.

Mining applications are handled through the Washington office of the RFC and not through the regional loan agencies, as is being done with direct loans for other industries. Former Senator Charles B. Henderson, of Nevada, who is a member of the RFC Board, is in general charge of loans for those engaged in metal mining. He has arranged that all mining applications and inquiries will be handled by the existing machinery in the self-liquidating division of the Corporation. John E. Norton, of that division, is a mining engineer who has been a member of the RFC staff for more than a year. For that reason he is familiar with its work and is in a particularly good position to give these applications the necessary specialized supervision. Mr. Norton was born in Salt Lake City, but was reared and educated at Butte, Mont., where he was graduated from the School of Mines. Later he took the mining course at Columbia University. He served on the engineering staff of the Anaconda company from 1910 to 1930. After leaving Butte he did engineering work in South Africa until his return to this country to take a place on the engineering staff of the RFC.

Assisting Mr. Norton in the handling of these applications is D. M. Rait, a mining engineer from Warren, Ariz.; Emmet Hale, a mining engineer from Montana; and W. Rowland Cox, a consulting mining engineer, of New York.

When applications seem sufficiently promising to justify an examination of the property, a mining engineer of the locality, familiar with local conditions, will be engaged by the Corporation on a per diem basis, plus expenses, for that work. It is not planned to set up a large mining engineering staff in Washington. In this way it is expected to give some employment for a large number of engineers throughout the West.

Inquiries reaching Washington indicate that bank loans are practically unobtainable for mining properties whose only collateral is reserves of ore in the ground, but it is not necessary for applicants to show that mining loans may not be obtained through regular channels. With the higher prices for gold and silver, it is believed that many properties in which orebodies have been blocked out now constitute sound risks.

Every effort is being made to solve a serious difficulty that has arisen in connection with these direct loans. Many developed properties had to close earlier in the depression. Before any examination can be made they must be unwatered. In many instances the expense of unwatering is more than the owner can undertake. It has been suggested that when evidence can be produced as to the value of reserves under water, sufficient money be advanced for the necessary pumping, so that an examination can be made. It is believed that this can be arranged where the records are adequate to show that there is proven ore in the mine.

Apparently the first loans will go for the reworking of old dumps. A large number of these now can be worked profitably, it is believed, with the higher price of silver.

There is the greatest need, it is stated at the RFC, for those interested in these loans to familiarize themselves with paragraphs 3 and 4 of RFC Circular No. 14. Those paragraphs read as follows:

"3. Eligibility—Applications will be received only from recognized and established corporations, individuals, and partnerships engaged in the business of mining, milling, or smelting of ore. 'Recognized and established,' as applied to corporations, individuals, or partnerships, means that the business of mining, milling, or smelting of ore in which the applicant is engaged must have been established at such a time prior to the filing of the application that such business shall have obtained recognition in the business world. The word 'ore' means any native compound from which a metal or metals can be extracted at a profit. Thus, coal and other non-metallic minerals, salts, or other substances taken from the ground do not come within the purview of this section.

"4. Security Requirements—Section 14 of Public Act No. 417, Seventy-third Congress, requires that all loans thereunder shall be made upon 'adequate security, based on mineral acreage.' 'Mineral acreage' is mining property (land and/or mineral rights) on which there has been a reasonable amount of development and at least a partial blocking out of ore. If the mining property is owned by the applicant, a first mortgage thereon (including plant, equipment, and water rights) will be required. If the mining property is held by the applicant under a lease either with or without bond or option to purchase, an assignment of all the applicant's rights under the lease may sometimes be adequate security, although a first mortgage on the property and an assignment of the owner's royalty rights may also be required. Ordinarily, also, the applicant will be required to make an arrangement satisfactory to the Corporation by which the Corporation will receive a reasonable percentage of all receipts received by or due to the appli-

cant on account of the sale of ore taken from the property on which the loan is based; and an assignment of a favorable milling, smelting, sales, or transportation contract may also be required. The following may also be acceptable to the Corporation as additional security: a first mortgage on chattels, an assignment of current accounts or notes receivable, trade acceptances, warehouse receipts on ore or metals stored in bonded warehouses, or a first lien on other assets of sound marketable value."

Social Legislation

A major function of the next Congress will be the formulation of social legislation. The President is confidently expected to demand at least some form of mild unemployment insurance. That the more drastic plans which are glibly discussed about the Capital City will take legislative form is not likely.

In this connection, an important precaution on the part of the mining industry is to avoid undue nervousness when alarming trial balloons ascend later this fall. Undoubtedly already some such balloons are being inflated to test both the direction of the wind and the accuracy of the anti-aircraft fire from those who must pay the gas bills for inflation. When the temper of the public—and business—has been learned, a more sober, workable plan of legislation can be expected to evolve. As it evolves, industry can take quite seriously even details of proposals; but not until then.

One of the major brakes on this legislation is expected to be the prospective cost. Of course, in the end business must pay the bills. But in initial periods Government will in part foot them, and in part will suffer losses of taxing power as it asks industry to pay. For this reason the immediate effect in money cost of the new social plans is likely to be modest. Of much greater importance will be the ultimate effect which actuarial calculation will indicate even in advance of its impact. It is never too soon to count such future costs and insist that they be faced by the legislators.

New Code Authority

Precedent-making for *all* industry is the right granted to the Code Authority of the macaroni industry in the recent decision of NRA. That body is given tentatively the right to levy fines on members of its industry who violate the code. Thus, the ruling proposes that a much larger measure of self-discipline may be accomplished by an industry agency. Under the limitations, including that which requires consent of an individual company to this new authority, the new plan is admittedly experimental. If it works, however, NRA officials would hope that other industries might accept a like job of self-policing.

Settlement of the textile strike was accomplished last month only after definite influence had been exerted by the President personally. This, Washington believes, again evidences the fact that in major wage controversies and precedent-making labor disturbances, regardless of industry or location, the President will not be able to escape some measure of activity. Obviously, however, all expect that the President will participate as little as may be feasible in each case, both for political reasons and for personal convenience. Under these circumstances, therefore, Washington believes that the President himself must have assented to the idea of definitely greater union recognition in so far as this was a part of the textile strike settlement. Some forecasters, as a consequence, read into that settlement a further leaning of the Chief Executive toward support for nationally organized labor, even A. F. of L. *per se*. Others claim that the President continues his support for proportional representation of minorities, as in the automobile strike settlement.

New Mines Station

PWA has announced an allotment of $200,000 with which the Bureau of Mines may build a new Southern experiment station. Most active as proponents of this allotment have been Representative Oliver, influential as chairman of the appropriations subcommittee of the House of Representatives, and President Denny of the University of Alabama. Expectations are that plans will be developed for the new building on the campus of the university, assuming that appropriate dedication of land is granted the Government. There the building will become a substitute home for the quarters now provided for the Bureau gratis by the university.

The Bureau has as yet announced no plans for modifying its present Southern investigations, most of which relate to beneficiation of Southern coal and ores. Expansion of this work would be contingent on new appropriations for current expenditures. In fact, the new building imposes some maintenance and operating burdens which may actually curtail present technical investigations unless added funds are granted, effective by the date of completion of the building.

The oft-requested plan for a new experiment station of the Bureau of Mines at College Park, Md., a suburb of Washington, has been delayed. Maryland political lights are, however, stirred anew to activity by the Alabama grant. If a College Park station is established it would be a new agency, primarily intended as an incubator for preannouncement study of ideas of the Washington administrative staff of the Bureau. None expects, however, that such a station, which would be the twelfth operated by the Bureau, would supplant any present field activities nor discontinue any of the work in the present stations.

Copper and Tin

Economic remedies for the copper situation are offered in all quarters. All of these, however, must start from the premise that the present 4c. duty on copper expires by limitation of the law next June. In view of the present attitude of the Administration toward high tariffs, and its desire to promote foreign trade, there is no large confidence that an extension of the 4c.-per-pound burden on copper will be continued by Congress.

Economic observers point out that the tin cartel is seeking to use its authority for isolating surplus stocks as a means not only for stabilizing, but also for raising, the price of the metal. Although visible world stocks free to move in trade have shrunk to about a normal ratio to consumption, continuance of this policy is expected. One consequence of it already noted is the intensive research in Germany to develop tin substitutes. That was an inevitable effect of the official curtailment of tin imports into the Reich. Should that research and the analogous activity of investigators in all other principal user countries afford successful economic substitutes, the collapse of the tin cartel program, of course, would follow. As yet, however, no convincing evidence of such major success on the part of user groups has been disclosed either in Germany or elsewhere.

PWA Financed Surveys

PWA money has provided for about a dozen field studies by the United States Geological Survey during the past few months. Preliminary reports on some of these, particularly the reports relating to quicksilver in Arkansas and fluorspar in Illinois, have roused interesting comment and speculation.

The quicksilver studies in Pike County, Ark., have related to the occurrences of cinnabar there, which were described by State Geologist G. C. Branner some time ago. Detailed investigations by the Survey, in cooperation with the State, are being made over an area several miles wide and from 20 to 25 miles long. Official comment, of course, is being withheld until the completion of the field work, though a summary of the summer's findings is hoped for late this fall or early winter.

The fluorspar occurrences in Illinois, still under investigation by U.S.G.S., are privately described about Washington as being of stupendous magnitude. Some estimate that one identified occurrence, apparently extending under a single farm of 200 acres, and no one knows how much further, certainly contains at least a three-million ton reserve of 50 per cent equivalent spar.

Australia to Air Map and Survey Areas in Three States

NEXT MARCH the Commonwealth Government of Australia will begin its aerial photographic, geological, and geophysical survey of three areas, each of 10,000 square miles, in Queensland, Central Australia, and Western Australia. Completion of the project will probably require about three years. Total cost of the survey is estimated at £150,000. In this governmental action is seen further indorsement of geophysical and aerial means as aids in developing the country's mineral resources. Similar methods have also been employed by a number of private interests during the past year (*E.&M.J.*, March, 1934, p. 134; May, 1934, p. 232). News of mining developments during recent weeks in the various sections of Australasia and New Zealand follows:

Western Australia

Great Boulder Proprietary is preparing designs for a plant to treat dumps totaling 2,900,000 tons. The dump material is cemented with gypsum. A new plant using flotation-roasting and cyanidation is in operation. It has a capacity of 12,000 tons monthly.

Paringa Mining & Exploration, which has proved four lodes on its 24-acre lease at Kalgoorlie, is making good progress with unwatering and re-equipping the property. Condition of the main shaft has been found to be good. The water has been lowered to the 400-ft. level. This small lease, according to reports, is likely to become an important producer.

Ora Banda Amalgamated Mines is proceeding with the installation of a treatment plant on its leases at Ora Banda. The plant will comprise units for coarse, crushing, fine-grinding, agitation, filtering, and precipitation. Rich ore has been encountered in the shallower oxidized parts of the reef that runs through four leases.

Westralia Renown Mines has been floated in Adelaide to acquire leases on 210 acres at Mount Morgans, in the Mount Margaret gold field. Development on the recently found faulted reef below the 350-ft. level is to be carried out. A dump of 180,000 tons is available for treatment.

Queensland

Mount Morgan, Ltd., is extending its plant to treat 5,000 tons weekly. For the four weeks ended July 25, 13,420 tons, assaying 5.66 dwt. gold per ton and 0.50 per cent copper, was treated, yielding 559 tons of concentrate containing 2,185 oz. gold and 56 tons of copper.

Golden Mile (Cracow), which has been having considerable difficulty with the treatment of its ore because of bad sliming, has had its first clean-up, 155 oz. of bullion being obtained from 175 tons. The plant has a capacity of 50 tons daily.

Victoria

Placer Development has acquired dumps aggregating 2,000,000 tons and containing gold worth about 7s. per ton Australian currency, in the Rutherglen district. The dumps consist of the clayey residue from the puddling machines used in the treatment of the deep lead wash about 25 years ago. A pilot cyanide plant capable of treating 50 tons per day is to be erected, and, if results are satisfactory, a plant to handle 1,000 tons daily will be installed.

The Little 180 mine at Bendigo has struck an enrichment and is treating the high-grade ore. About 2 dwt. gold per ton meets all working costs, leaving a substantial profit. The Hercules Company, which since July, 1922, has paid £127,500 dividends, is sinking a new shaft.

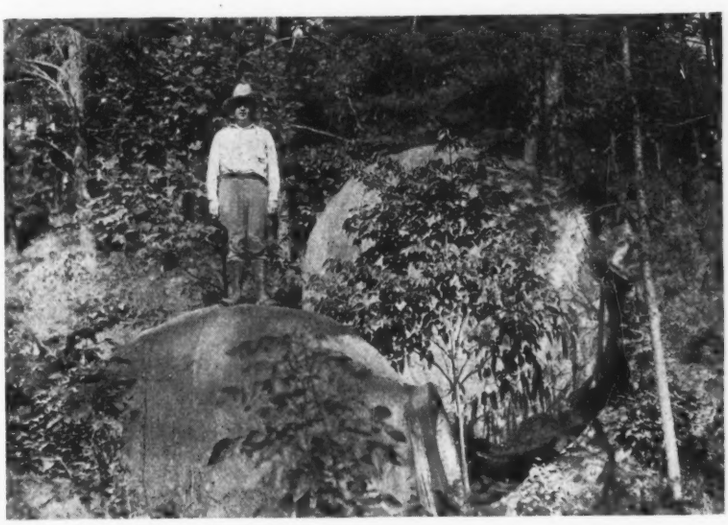
Adelong Gold Estates' dredge, operating at Bright, treated 238,950 cu.yd. for the period November-April, 1934, for a yield of 860 oz., equivalent to 1.728 grains gold per cubic yard, or 6.8d in Australian currency. Operating cost was 4.11d. per cubic yard. A new bucket band has been installed and the dredge is now digging 15,000 cu.yd. weekly.

During the half year ended June 30, 1934, 63 gold-mining companies were registered in Victoria, which is 28 more than in the corresponding period of last year. The nominal capital of these companies is £1,665,525 and the subscribed capital £1,351,500.

New Zealand

New Zealand has recently revised and consolidated its laws relating to gold mining, and the new law includes the following features: (1) Authorized persons can enter land for geological and geophysical surveys, provided the owner is compensated. (2) Mining rights on land that has involved survey expenses are granted by the Government. (3) The maximum area for a prospecting license has been increased from 100 to 1,000 acres, but a substantial deposit is required to insure fulfillment of conditions. (4) Licenses must not be transferred without written consent of the Government. (5) The maximum length of a dredging claim along rivers has been increased from 3 to 16 miles and the area from 75 to 600 acres. (6) Licenses for business and residence sites along streams must be obtained. (7) Rentals of claims have been modified. (8) Hoist men at slopes or inclined shafts being sunk must be certificated. (9) Particulars of boreholes must be supplied the Government by those who wish to drill. (10) Where practicable, underground mines shall have two outlets.

"Ruins" of a futile attempt to roast pyritic gold ore. Current activity in a section of the Appalachian field leads to the discovery of two hollow concrete globes, 12 ft. in diameter. Each globe was apparently rotated by a belt passing around the circumference. Finely ground ore was blown through one opening into the presence of a flame from a gasoline torch applied at an opposite opening.



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Mond Nickel in Finland

Mond Nickel is reported from Helsingfors to have secured from the Finnish Government the exclusive right to prospect for nickel at Petsamo, in northern Finland.

PERSONAL ITEMS

R. W. Gallup is planning to go to Colorado to engage in mining work.

Victor A. James has been appointed manager of the Arntfield gold mine, in the Rouyn area.

Dr. Henry M. Payne, of McGill University, inspected gold-mining claims near Safford, Que., recently.

H. S. Munroe, of the Rhokana Corporation, London, has returned from America and again sailed for Africa.

John D. Mitchell has purchased a gold-silver property near Byars, Okla., from C. T. and J. C. Foster, of Mesa.

Fred E. Johnson has left the United States Geological Survey to join the staff of Arizona Consolidated Mines Company.

Charles A. Ordway, of 3826 Pine Grove, Chicago, is leaving for a tour of Nevada and Utah in the interest of investment bankers.

Stephen L. Brown has returned to the Miami Copper Company from his recent association with the Piute Mining Company at Cantil, Calif.

J. O. Ambler is inspecting the plant of Orula Grube Aktiebolog, at Thamshavn, Norway, for the Rio Tinto Company.

Harry Sparks is manager of the Cadillac-O'Brien gold mine, in northwestern Quebec, the operations of which are soon to be expanded.

R. H. Stewart, consulting engineer, of Vancouver, has taken over the full direction of the Taylor-Windfall property in the Taseko River area.

Walter J. Eaton has joined the staff of the exploration department of the Howe Sound Company as assistant to S. J. Clausen, chief engineer.

C. W. Cayser, of the underground survey staff of Sons of Gwalia, Ltd., Leonora, W. A., has been appointed manager of Edna May Mines, Ltd., Westonia, W. A.

Charles F. Jackson is now on six months' absence from the United States Bureau of Mines and is in charge of the Bussieres mine, at Amos, Quebec.

John A. Fulton, director of the Mackay School of Mines of the University of Nevada, lately investigated gold developments in Nevada.

Bennett R. Bates sailed on the "Majestic" on Sept. 20, for London. From there he is going by plane to the Lupa gold field, in Tanganyika Territory, for the East African Goldfields, Ltd.

Arthur Swanson has resigned as general manager of Minas Los Lugos, S.A., Mezquital del Oro, Zacatecas, Mexico, and will spend two months vacationing in Idaho and British Columbia.

Frederick M. Becket, past president of the A.I.M.E., was elected an honorary member of the Electrochemical Society at its meeting in New York City last month.

Mark L. Requa has been in southern Nye County, Nev., to supervise mill tests on ore from the Gold Ace mine, upon which he and California associates have taken an option of purchase.

R. J. Parker, assistant to the managing director of Roan Antelope, Rhodesian Selection Trust and Mufulira Copper Mines, left London recently for America.

Henry C. Carlisle has been at the Bishop Creek mine, in Inyo County, Calif., for which he is directing engineer, returning by way of Reno to his San Francisco headquarters.

Dr. J. F. Walker, formerly with the Geological Survey of Canada, has been appointed Provincial Mineralogist for British Columbia, and entered upon his new duties on the first of September.

P. B. Nye, government geologist of Tasmania, will take charge of the photographic-geological-geophysical survey to be carried out in northern Australia by the Commonwealth Government.

W. P. Alderson and **A. A. McMartin,** who have spent the last two years prospecting in Kenya and Uganda, left Nairobi by airplane on Sept. 21, and are expected to arrive home in Montreal about Oct. 15.

R. J. Morgan has been selected for manager of the recently organized Kimingini Gold Mining Company, Ltd., which is being rapidly equipped for the treatment of 100 tons of high-grade gold ore daily.

A. S. Howie, general manager Trepca Mines, Ltd., and other Selection Trust interests in Yugoslavia, has been in Scotland for two months, where he has undergone an operation on the stomach. He expects to return to Yugoslavia early this month.

C. E. Bersinger is now employed by the Anglo-American Mining Company at its Oceanic mine, after spending twelve years on the staff of the United Verde Copper Company, at Jerome, Ariz.

Lotan C. Read, of the Craig Gold Mines, Ltd., Ontario, Canada, recently went to San Francisco to purchase equipment for a 50-ton mill for the Craig mine. On his return East he made an examination of gold properties in Cripple Creek, Colo., which he managed in 1900.

J. D. Galloway, formerly Provincial Mineralogist for British Columbia, attended the meeting of the A.I.M.E. in Spokane on Sept. 28-29, and presented a paper on the current activities in the gold-mining camps of the province.

E. J. Carlyle, secretary of the Canadian Institute of Mining and Metallurgy, has been visiting the Western provinces following the annual western meeting of the Institute in Calgary, which he attended.

Clarence Woods, who had been on a visit of three months in the United States, returned on Sept. 29 to Peru to resume supervision of the Inca Mining & Development Company and the Inambari Gold Concession, which he controls.

P. H. Miller, formerly connected with the Homestead Iron Dyke Mines Company, and discoverer of the Bay Horse mine, Baker County, Ore., is now assistant superintendent of the Opp mine, operated by the Pacific States Mines, Inc., at Jacksonville, Ore.

W. C. Douglass, who has been assistant manager of the Auburn Chicago Mining Company at Penryn, Calif., has moved to Hedley, British Columbia, to accept the position of general manager for the Kelowna Exploration Company.

A. J. McDermid relinquished his position with the Miami Copper Company on Aug. 23 and has entered the Government service as a junior assayer at the New York Assay Office. For some years Mr. McDermid had acted as Arizona news correspondent for *E.& M.J.*

J. C. Coldham, formerly field engineer in Queensland for Gold Mines of Australia, has succeeded **A. S. Lilburne** as general manager of Raub Australian Gold Mining Company, Pahang, F. M. S. Mr. Lilburne has retired on account of ill health.

Dale L. Pitt, who for several years has been identified with the successful operation of the Premier mine, in British Columbia, has left for Australia, where he will be in charge of the development and operation of a property owned conjointly by the American Smelting & Refining Company and Premier Gold Mining Company.

Milnor Roberts, dean of the College of Mines of the University of Washington, has been engaged during the past field season in examining gold properties in Washington, Oregon, Idaho, and British Columbia, and also, with the Washington State Council, in studying the mineral resources of that State.

Harry Chellson, author of the article entitled "Cost of Operating a Medium-sized Gold Placer," which appears on page 441 of this issue, was graduated from the New Mexico School of Mines in 1923. His work as mining geologist has taken him to Mexico, various parts of the United States, Russia, Central Asia, and Eastern Siberia.

Dr. John Wellington Finch, Director of the United States Bureau of Mines, made an extended field trip in September for the purpose of visiting the principal stations of the Bureau. He visited Denver, Salt Lake, Reno, San Francisco, Spokane, Amarillo, Bartlesville, and Pittburgh.

Leonard G. Smith, manager of the White Eagle silver property on Camsell River, east of Great Bear Lake, has put in a year's supply of materials and equipment to continue the development, which so far has disclosed some excellent lenses of ore under conditions closely analogous to those of Cobalt, Ontario.

Tasker L. Oddie, former United States Senator from Nevada, has been appointed by Jesse Jones as special mining adviser to the Reconstruction Finance Corporation. He will work with the RFC in an advisory capacity to its board of directors, with the purpose of bringing about the widest possible cooperation between the RFC and the mining industry.

Andrew Fairweather, who has been visiting the mining districts of the United States and Canada during recent months in the interests of his company, which operates the Broken Hill South mine in Australia, brought his Canadian tour to a close on Sept. 12, when he addressed the Montreal branch of the Canadian Institute of Mining and Metallurgy. He remarked particularly on the bold and effective way in which the metallurgical problems had been solved at Britannia Beach, Kimberley, Sudbury, Flin Flon, and Noranda. Mr. Fairweather sails for Australia about Dec. 1.

OBITUARY

John Henry Banks, of New York City, mining engineer and international authority on gold mining, died on Oct. 3 at Espanola, Ontario, aged 73. Mr. Banks was a graduate of Columbia and a member of the A.I.M.E., which awarded him a medal in 1933.

Dr. Calvin Winsor Rice, executive secretary of the A.S.M.E. since 1906, died in New York on Oct. 2, aged 65. Dr. Rice graduated from M.I.T. in 1890, and rapidly won distinction in electrical, steam, and hydraulic engineering, and also as a scientist and humanitarian. Early in his career he was a consultant for Anaconda.

Baron M. P. de Friedland, a British mining engineer, died on Sept. 6 while on a prospecting trip to the Seward Peninsula, Northwestern Alaska.

J. C. Ingersoll, chief engineer for the W. F. Snyder & Sons Company, of Salt Lake City, was killed in a shaft accident at the Bluestone mine, near Stockton, Utah on Sept. 1.

Edwin C. Reeder, general manager of the Hillside Fluor Spar Company's properties in southern Illinois and Kentucky, died on Aug. 23, a week after an automobile accident in which Mrs. Reeder was instantly killed. Mr. Reeder was 53 years old. He was a member of the A.I.M.E., the Lake Superior Mining Institute, and the Masonic order. Mr. Reeder had made many contributions to technical literature, his most recent article being "Depression Developments in Fluorspar Mining," which was presented in the July, 1934, issue of *Engineering and Mining Journal.*

Edwin C. Reeder

Stuart Croasdale, mining engineer and metallurgist, died in Denver, Colo., on Oct. 1, aged 68. Mr. Croasdale graduated from Lafayette College, Easton, Pa., in 1888. He was a pioneer in smelter-smoke investigation, leaching of copper ores, volatilization, and hydrometallurgy. He had been professionally associated with the Holden Lixiviation Works, Gillette Reduction Works, Globe Smelting & Refining Company, Anaconda, Burro Mountain, Calumet & Arizona, Utah Copper, and Nipissing.

Ludwig Vogelstein

We were shocked to learn of the sudden death of Ludwig Vogelstein, Chairman of the Board of the American Metal Company, Ltd., on Sept. 23. A week previous he had been a picture of health and buoyant in spirit. His death removed from the mining and metallurgical industry one who could ill be spared; and also from the Jewish faith in America, in which he was likewise a leader; and from the ranks of philanthropists.

Ludwig Vogelstein

Vogelstein was a many-sided man, which his friends in the mining and metallurgical industry did not always appreciate, for they saw only one side of him; but all of his sides were good. In my own friendship with him, dating back to about 1898, when he had been in this country only two or three years, and when he occupied a little office, a single room, in Nassau St., New York, I learned more than one of his sides.

The son of a rabbi in Bohemia, now part of Czechoslovakia, he had a scholarly background, and all his life he was a scholar, not in the narrow academic sense, but in a broad, pragmatic way. Naturally his mind turned toward economics, and equally naturally it was so turned with a soundness that characterized his thoughts in every way.

Vogelstein recently had occasion to prepare a brief sketch of his career, especially in connection with metal production, and although I might be less matter-of-fact than he, for with some of the enterprises I had certain associations, I prefer to quote his own words, as follows:

"In November, 1896, I came to the United States. After a short employment by the Nassau Smelting & Refining Company, I opened an office of my own, principally representing Aron Hirsch & Sohn, of Halberstadt. In 1901 I built, together with Capt. J. R. Delamar, what is now known as the Carteret plant of the United States Metals Refining Company. In subsequent years I was instrumental in erecting the works of La Harpe Zinc Company and was actively connected with the American Lead, Zinc & Smelting Company, promoting the building of smelters at Caney and Deering and near East St. Louis. I was also connected with the United States Smelting, Refining & Mining Company. I assisted in the erection of the electrolytic copper refinery near Sydney, N.S.W. I built a zinc plant at Fort Smith, Arkansas. At the beginning of the War I severed my relations with Aron Hirsch & Sohn and at the end of 1919 bought a substantial interest in the American Metal Company, Ltd., liquidating the business of L. Vogelstein & Company."

This is told with characteristic modesty. There is nothing said about the consolidation and development of a mining and metallurgical empire in Mexico, the improvement of metallurgical scope and practice at Carteret, the leadership in modernizing zinc-smelting practice at Langeloth, so as to become able to beneficiate the flotation ores, and finally the quick perception of the importance of the copper deposits in Rhodesia and the acquisition of major interests in two of their greatest. In all of this the American Metal Company was being expanded from what was originally a merchandising concern into a great operating organization.

In all of this Vogelstein was the guiding spirit, and not the least of his qualities, perhaps I should say the best of them, was the organization that he created. There was never an industrial leader who was more beloved among the personnel that worked under him.

There was, however, a broader phase in his relations to the industry, which he revealed in the numerous economic contributions that he made to the technical press and in addresses to the Mining and Metallurgical Society of America. Yet these were only reflections of what he was able to give in industrial councils, wherein his economic discernment and pungent expressions were prized. There were few in the industries of copper, lead, and zinc who knew the economics of the production and consumption of those metals and the mechanics of their markets so thoroughly as did he. In each of those industries he was deeply respected and in each of them there is a feeling that a great mind has been lost by them.

I think that Vogelstein lived a happy life. Nothing could disturb his serenity. During the last four years of adversity, afflicting everybody, he was ever courageous; indeed he preserved the cheerfulness that goes with serenity. He never married, but he was unremittingly solicitous for his brothers and sisters, and for his friends. In them he lived, and in his private, unheralded philanthropies, and in his religious faith, of which he was proud, but above all in his constructive work. He loved to travel and to visit the museums and libraries of Europe, and out-of-the-way places. An important thing that helped him always was his possession of a sense of humor. In his own wit there was never any sting. Those of us who knew him best will remember him as a genius, who was at the same time a real man, and a good sport.

W. R. INGALLS.

NEW BOOKS

American Industry's Attainable Capacity

AMERICA'S CAPACITY TO PRODUCE. *By Edwin G. Nourse and Associates. Washington, D. C. The Brookings Institution. Pp. 608. Price $3.50.*

The body of this book is concerned with estimating the "practically attainable" capacity of representative American industries and the ratio of actual utilization for the period 1925-29. Where possible the trend of this ratio from 1900 to 1930 is also studied. "Practically attainable" capacity is defined as the capacity that can be reached under conditions of operation which business actually experiences. For purposes of measurement it is taken to be full-time working capacity, as that is determined by the customs of each industry, minus allowances for seasonal variations in demand and for shutdowns for repairs and other like factors. Full-time working capacity is measured either by "rating" the capacity of industrial equipment or by some method which uses the maximum output for some part of a year, such as a day, a month, or other selected period, as an indication of what the annual output might have been if this peak rate of production had been maintained throughout the year. For example, in the copper industry the capacity of copper refineries is based upon the estimates of rated capacity made by W. R. Ingalls, and the annual capacity of the mines is derived by multiplying by four the peak three-month output. The second method automatically takes care of completely idle plants; in the first method these plants have to be given special consideration. Though in isolated instances estimates may possibly be questioned, this book undoubtedly presents an important contribution to our knowledge of the actual operation of our economic system prior to the great depression.

The object of the book, however, is something more than the mere measurement of capacity of individual industries. It also hazards to estimate the increase in the output of American industry as a whole which would be possible under a condition of simultaneous production at full capacity, allowance being made for the coordination of inter-industrial demands and the availability of an adequate supply of labor. Though the precise figure derived is little more than a mere guess, it shows that a considerable gain in output is possible, even above the level of 1929. Further studies of which this book is the first, hope, through an investigation of the actual distribution of consumer purchasing power and the methods of capital formation, to point the way to remedies in our existing practices of distributing wealth which will enable us to attain at least a part of this potential gain.

ACHESON J. DUNCAN.

Mining Practice

PRACTICAL MINE DEVELOPMENT AND EQUIPMENT. *By Lucien Eaton. McGraw-Hill Book Company, New York, Pp. 405. Price $5.*

This book really fills a gap in mining literature. Mr. Eaton, a graduate of Harvard and long a superintendent for an important Lake Superior operator prior to taking up consulting work, writes with an intimate knowledge of necessary detail and with a facility rare among engineers. A feature of his treatment of the subject is the way in which he shows the reader how to proceed to develop and equip, helping him at every step with a wealth of "note-book" data. This gives the volume unusual practical value. While an outgrowth of a series of articles that appeared in *Engineering and Mining Journal* from 1932 to 1934, it contains considerable material hitherto unpublished. No similar volume is to be had, particularly with respect to American mining practice. It will supplement exceedingly well such other books on mining as are likely to be found on the bookshelf of an engineer or student.

Contents are indicated by the twenty chapter headings: Shafts; Level Development; Mining System; Shaft-Sinking Equipment; Rock Drills and Accessories; Explosives; Mechanical Loading; Timbering; Air Compressors and Pipes; Transportation; Skips and Cages; Caging and Skip-Loading Devices; Hoists; Headframes; Drainage; Ventilation; Disposal of Waste and Stocking Ore; Change House; Shops; and Accident Prevention. The volume is well illustrated.

Structural Geology

GEOLOGIC STRUCTURES. *By Bailey Willis and Robin Willis. Third Edition, Revised. McGraw-Hill Book Company, Inc., New York and London. 1934. Pp. 544. Price $4.*

In one sense this is the third edition of a well-known text. In another sense it is a new book. Not only is new material inserted and old material left out, but the four sections of the second edition are gone, and even when material is retained it is often in a different order. For instance, chapters 1, 2, 3, 5, 6, 7, and 9 of the old edition correspond roughly to 3, 4, 6, 7, 6, 11, and 12 of the third. No student can "get along" with the second edition of this work in place of the third! It is the ripened fruit of geologic teaching for a quarter of a century, geologic field work for over half a century, expressed with the verve of literary style characteristic of the family for over a century.

Though its main thesis is geologic structure, like the second edition it ranges widely, touching everything from the psychology of the geologist who investigates structures, to the history of the planet on which they are produced and the forces producing them within and without. The book embodies the ripened fruit of much field work in all continents and also of well-known experiments. Its treatment of the dynamic spheres of the earth, the "stereosphere," has been curtailed to make room for references to isostasy and Meinesz' gravity observations at sea. Also, Arthur Holmes' recent work on radioactivity, geologic time, and mountain building has been brought nearly up to date.

Material in the second edition has been curtailed in the third, for instance the detailed explanation of the Rhine Valley and the lengthy discussion of the planetesimal and rival theories. So that in spite of much new material and a long appendix on the technical aspects of faulting, the evidences of fault displacement and their nomenclature, the book is only some 26 pages thicker. The theme of the book is mainly faulting and folding. Possibly a later edition may remove further extraneous matter and give larger space to minor rock structures like boudinage, bioherms, the characters by which Bailey and Tanton told which side up certain strata of Scotland were, the details studied by Bain, and the tumors and large speculations of Haarmann. ALFRED C. LANE.

Gold at Leesburg

HISTORY OF LEESBURG PIONEERS, *By O. E. Kirkpatrick. Pyramid Press, Salt Lake City, Utah. Pp., 172. Price $1.50.*

Leesburg is in Lemhi County, Idaho. Gold was discovered near there in 1866. The Pioneer Mining Company, employing 73 miners at $42 a week each, cleaned up $58,000 in 1867. Bedrock was rich. Leesburg grew to have a population of 3,000 people, but it is now a fraction of that. The total gold production is $16,000,000. In 1926 a tablet was dedicated commemorating the sixtieth anniversary of the discovery of gold in the district. Between Salmon and Leesburg are many claims which may be productive. Mr. Kirkpatrick,

himself a pioneer and mine owner who has been a local factor, and once a contributor of mining notes to the *Mining and Scientific Press,* San Francisco, sent the reviewer a copy of his well-presented and printed book. He gives *the* pioneers (Sharkey, Mulkey, Smith, Rapp, and Girton) and others a half-page to a three-page notice written in appreciative and sympathetic tone. A few early women of Leesburg are mentioned. A pity that more men like Kirkpatrick don't record what happened in opening other fields. The prospector is the pioneer of civilization!

M. W. von Bernewitz

Gold Seeking

Prospecting for Gold and Silver. *By E. M. Savage. McGraw-Hill Book Company, New York. Pp. 307. Price $2.50.*

A feature of this small, well-illustrated book is the inclusion of 61 so-called operating sheets. These, though short, are not limited to page length, as the word "sheet" might suggest. The term "instruction" also might be better than "operating," inasmuch as each of the sheets presents specific instructions, in successive steps and in simple language, with or without the aid of illustration, as to how to go about doing a certain task. Sheet No. 1 is entitled "How to Pan Gold"; No. 2, "How to Amalgamate a Copper Plate"; No. 4, "How to Make a Clean-up on a Rocker"; No. 22, "How to Lay Out a Lode Location," and so on. The text accompanying these sheets is equally practical.

Survey of Spain

La Interpretacion Geologica de las Mediciones Geofisicas (Geological Interpretation of Geophysical Measurements). *The Report of the Geological and Geophysical Survey of Spain. By Jose G. Siñeriz. Madrid. Pp. 536, with 143 figures and 37 colored plates.*

This report, which was presented at the Sixteenth International Geological Congress, is in two parts. Part I treats only of the geological interpretation of seismic measurements. Part II combines this interpretation with that of gravimetric measurements. In the first three chapters the theory of seismic prospecting and the apparatus used are dealt with and a simple method of the author's own devising for determining the approximate depths of the layers of the subsoil is described. The next seven chapters deal with investigations in various potash areas, among them Callus, Suria, Sallent, and Tafalla. The rest of the book, referring to the geological interpretation of the gravimetric measurements, after disposing of preliminary theory, discusses investigations conducted at several places, including Burgo de Osma, Garrucha, and Tafalla. A method of calculating by simple arithmetical means the practical coefficients used for topographic corrections is presented for the first time by the author. Dr. Siñeriz also describes as a novelty his procedure in shooting blast holes and recording the instant of explosion.

Slushing

Underground Scraping Practice in Metal Mines. *By Charles F. Jackson, Manuscript Report No. 1, United States Bureau of Mines (Reprinted by Sullivan Machinery Company, Chicago). Pp. 88.*

Although the manuscript of this pamphlet was completed in March, 1933, the bulletin did not appear immediately and in general has received less attention than it merits. It is the most up-to-date report extant on scraping practice. The subject is treated in six sections: applications in underground work; principles of design; scraper hoists; accessory equipment; examples of scraping practice; and trends in practice.

Metal Standards

Standards and Specifications for Metals and Metal Products. *Compiled by the Bureau of Standards, United States Department of Commerce. Pp. 1359. Price, $3.*

This is the third volume of the Encyclopedia of Specifications, in preparing which the Bureau has been engaged for several years. Contributions have been made from over 80 nationally recognized organizations authorized to speak for industry or for the Government. It includes more than 1,600 standards and specifications covering ferrous and non-ferrous metals, their manufacture, methods of testing, chemical analysis, and heat-treatment. An extensive index is added.

Minerals in Minas

Die Bodenschätze des Staates Minas Geraes (Brasilien). *By B. von Freyberg. E. Schweizerbart'sche Verlagsbuchhandlung, (Erwin Nägele) G.m.b.H., Stuttgart, Germany. Pp. 453. Price, 54 Rm.*

Mineral deposits in Minas Geraes, fifth in size and first in population of the Brazilian provinces, include a great variety of metallic and non-metallic products, gold, platinum, diamonds, precious and semi-precious stones, iron, manganese, and others. Although gold was mined by the Portuguese early in the sixteenth century, much exploration work remains to be done. This volume is based on personal studies by the author over a period of five years, and contact with many prominent geologists and mining engineers of Brazil. It is well illustrated, has a number of geological maps, and extensive bibliographies.

Publications Received

Quicksilver Deposits of Southwestern Oregon. By F. G. Wells and A. C. Waters. United States Geological Survey Bulletin 850. Pp. 58. Superintendent of Documents, Washington, D. C. Price 30c.

Chumbo e Prata no Brazil (Lead and Silver in Brazil). By O. H. Leonardos. Bulletin 2, National Department of Mineral Producton. Rio de Janeiro.

A' Margem de "os Satélites do Diamante." By Djalma Guimarães. Monograph 2. Geological Survey, Minas Geraes. Belo-Horizonte, Brazil.

Arizona Lode Gold Mines and Gold Mining. By E. D. Wilson, J. B. Cunningham and G. M. Butler. Arizona Bureau of Mines, Tucson, Ariz. Pp. 261.

Elements of Mining for the Beginner. By Guy E. Ingersoll, Mines Information Bureau, State College of Washington, Pullman, Wash. Bulletin C. Forty mimeographed pages. Price 25c.

Battelle Memorial Institute. A brochure outlining the service to industry of this research institute at Columbus, Ohio.

The Brown Iron Ores of the Western Highland Rim, Tennessee. By Ernest F. Burchard. Bulletin 39 of the Division of Geology, State Department of Education, Nashville, Tenn.

Annual Report of the Minister of Mines of British Columbia, 1933. Victoria, B. C. Price 50c.

Annual Report of the Government Mining Engineer, Department of Mines, Union of South Africa. 1933. The Government Printer, Pretoria. Price 10s. 6d.

Geology of the Dargaville-Rodney Subdivision, Hokianga and Karpara Divisions, New Zealand. By H. T. Ferrar. Bulletin No. 34 (new series). Geological Survey Branch, Wellington, N. Z. Pp. 86, with a supplement of 17 maps. Price 17s.

The Witwatersrand System in the Klerksdorf-Ventersdorp Area. Preliminary report by Louis T. Nel. Geological Series, Bulletin No. 1, Geological Survey Division, Union of South Africa. Pp. 32. Price 1s.

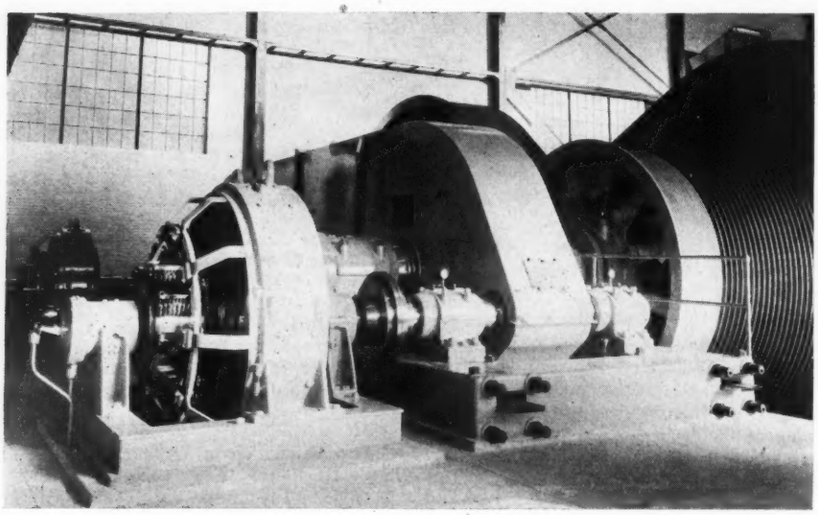
The Andalusite Sands of the Western Transvaal. By F. C. Partridge. Geological Series, Bulletin No. 2. Geological Survey Division, Pretoria. Pp. 16. Price 6d.

Der Löss und seine geotechnischen Eigenschaften. By Dr.-Ing. Alfred Scheidig. Published by Theodor Steinkopff, Dresden and Leipsic. Pp. 233, with 132 illustrations and 6 tables. Price, paper 18 Rm., bound 20 Rm.

Geology of Volcanic Area of Bufumbira, Southwest Uganda. By A. D. Combe and W. C. Simmons. Memoir No. III. Geological Survey, Entebbe, Uganda. Pp. 150. Price 15s. The Birunga lava field, covered in this memoir, provides one of the largest leucite-bearing areas and therefore perhaps one of the largest potash reserves in the world.

Compilacion de los Estudios Geologicos Oficiales en Colombia—1917 to 1933. Vol. I. Information relating to the work done by the National Scientific Commission, under the direction of Dr. Roberto Schiebe. Published by the Department of Mines and Petroleum, Bogota, Colombia. Pp. 475.

EQUIPMENT NEWS



Electrical Equipment for Homestake Hoist Marks Forward Step in Design

R. S. SAGE
Industrial Engineering Department
General Electric Company
Schenectady, N. Y.

Largest metal mine hoist in the United States.

Electrical equipment weighs 500,000 lb.

Hoist motor develops peak loads of 5,000 hp., but flywheel limits demand on power supply to 1,700 hp.

Flywheel on ore-hoist motor-generator set weighs 44 tons, has a peripheral velocity of over 4 miles per minute, and stores 164,000 horsepower-seconds.

Full control of hoist accomplished by adjusting and reversing generator field current through controller handling only 1/6 amp.

Equipment for the two bi-cylindro-conical drum hoists recently installed at the new Ross shaft of the Homestake Mining Company, Lead, S. D., marks a milestone in the development of the electric hoist, and, incorporating as it does unique features in both electrical and mechanical design, it should interest operators of the larger metal mines. The installation is noteworthy for its size, the ore hoist of 3,000-hp. capacity being larger than any other in metal-mine service in the United States, exceeding even the mammoth equipments in the copper districts of Montana and Arizona.

In this equipment the capacity was determined by calculation of many load diagrams based upon the schedule of tonnage output established for the various levels. The ore hoist operates in two compartments with normally balanced skips, each holding 14,000 lb. of ore. Drum speed of 35 r.p.m. gives an average rope speed of approximately 2,250 ft. per min., about 2½ min. being required to complete a trip from the lowest level of 5,275 ft. The man and material hoist operates with a 4,000-lb. two-car cage in a single compartment in connection with a 9,000-lb. counterweight.

The generator voltage control system for these hoists was clearly indicated, primarily as a consequence of the necessity for an equalizing means for the fluctuating loads which otherwise would have been thrown directly upon the power system, an intolerable condition in this case. Also, only this system assured the control and handling of such a large hoist in a safe and reliable manner.

In this system d.c. motors drive the drums, receiving power from individual generators which are part of a.c.-d.c. motor-generator converter sets. Dual motor drive was adopted for the ore hoist, permitting all motors and generators to be alike, inasmuch as the man hoist power requirements were just half those of the ore hoist.

Apparatus required for the two hoists is as follows:

Ore Hoist

Two 1,500-hp., 300-r.p.m., 600-volt hoist motors
One motor-generator set consisting of:
  Two 1,200-kw., 720-r.p.m., 600-volt generators
  One 1,750-hp., 720-r.p.m., 2,200-volt induction motor
  One 40-kw., 720-r.p.m., 250-volt exciter
  One 44-ton steel-plate flywheel

Man and Material Hoist

One 1,500-hp., 300-r.p.m., 600-volt hoist motor
One motor-generator set consisting of:
  One 1,250-kw., 300-r.p.m., 600-volt generator
  One 800-hp., 720-r.p.m., 2,200-volt induction motor
  One 40-kw., 720-r.p.m., 250-volt exciter
  One 34-ton steel-plate flywheel

The hoist motors are connected by flexible couplings to the hoist-pinion shafts, two for the ore and one for the man hoist. The motors have rolled-steel, field-magnet frames and electrically fabricated armature spiders and bases. Generator frames likewise are of rolled steel. Driving keys in the motor armature spiders, also those securing the flexible couplings to the motor shafts, are of the double tangential type.

Both commutating pole windings and main pole face windings are provided for the hoist motors and the generators, so that the heavy current incident to the frequent acceleration, retardation, and reversing service can be successfully commutated.

In this installation the induction motors are of the wound-rotor type necessary for securing the required variation in speed for effective utilization of the flywheels. Capacity of these motors corresponds to the average load requirements of the hoist during a hoisting cycle. Inasmuch as the peak loads are carried by the flywheels, the load on the induction motors is nearly uniform while hoisting.

Wheels built of rolled steel plates 116 in. in diameter give a peripheral velocity of 22,000 ft. per minute. Their size and weight are such that all normal duty cycles may be completely equalized; that is, all load developed by the generator above the average is carried by them. Thus, although during a lift from some of the levels the ore-hoist motors develop a load of 5,000 hp., only 1,700 hp. is drawn from the power supply lines.

Means of starting, stopping and maneuvering the skips and cage with precision and safety are provided in the adjustable generator voltage control system employed for both hoists. Dynamic braking is automatically afforded when retarding or lowering overhauling loads, thus providing safety without resorting to the mechanical brakes. These serve principally to hold the drum stationary between trips.

The operator has control of the generator voltage and, therefore, of the motion of the hoist by means of a master switch operating in connection with a magnetic contactor panel which controls the amount of field current supplied to the generators. Hand control of the speed is provided over twelve graduated steps from standstill to full speed in both directions of rotation. In addition, relays are included whereby, if the master switch should be moved instantly to the full speed position, the contactors will close in proper sequence in such a manner as to bring the hoist grad-

ually to full speed and to protect the motor and generator against excessive currents. Similar relays give protection against too high currents during retardation.

An automatic speed regulator for each induction motor functions to reduce its speed, thereby allowing the flywheel to give up its stored energy and assist in driving the generator whenever the load on the induction motor exceeds the value for which the equipment is adjusted. The regulator is of a new design with provision for ready adjustment of operating values of line current.

The equipment includes features to function during various exigencies to insure operation at such times in a safe and efficient manner. Under such situations as would make further operation unsafe, devices are arranged to remove power automatically from the hoist motors and simultaneously to apply the mechanical brakes. Such apparatus as speed indicators, indicating instruments, and similar accessories are also included.

New Compressor Weighs Less —Uses Less Fuel

Anticipating a demand for a portable air compressor that would have greater capacity for its size and weight and a lower fuel consumption than any hitherto built, the Sullivan Machinery Company, Chicago, has introduced a new portable model (Type WK60) which is a two-stage angle- or V-type unit, having the air end air-cooled. This design is said to reduce fuel consumption, which is furthermore decreased by the used of a new valve having a large port area and a low lift. Minimum resistance to air flow is provided in the design of the air port and the air packing. The base is of welded structural steel and the main bearings are of the anti-friction type. Parts have been made as few and as light as possible.

Feeding Rock Breakers Regularly

In the course of a visit to various mines in Australia during the past year, M. W. von Bernewitz noted Ross chain feeders rendering effective service at several plants where they were employed for maintaining a uniform feed to rock breakers. Data pertaining to these installations are given in the accompanying table. The feeder mentioned has already been described at length in *E.& M.J.*, April 20, 1929, and March 24, 1930.

Electric Arc Saw

Speed in cutting iron, steel, and alloy metals is said to be possible with the so-called Strobel electric arc saw, developed by the Rich Manufacturing Company, Los Angeles. No change in temper or structure of the substance cut is said to take place. The device utilizes the heat of the electric welding arc and a circular saw made of soft alloy steel. Molten metal, instead of cold metal, is removed as the cut is made. In operation, the arc, which is formed between the teeth of the rapidly rotating blades and the material to be cut, heats the metal directly in the saw's path to a plastic or molten condition, so that pressure created by the blade can clear the metal from the scarf. Due partly to the fact that the blade rotates in a magnetic field, the arc is concentrated on the material directly in front of the teeth, and inasmuch as the speed of travel through the material to be cut is high, the concentration at any given point lasts for only a short period. The result is that a shallow overheated area, not exceeding 0.003 in. in depth, is produced at the sides of the scarf, and the saw blade remains comparatively cool. This overheated area is said to be negligible in comparison with that produced when the cutting is done with an oxy-acetylene torch, or even with a friction saw. The machine may be had in several standard mountings. To generate the arc, either a d.c. welding generator or an a.c. welding transformer may be used. The leads from the current-generating unit are attached to the switch mechanism of the sawing machine and the current is regulated just as it would be for ordinary electric arc welding.

Liquid Belt Dressing

What constitutes the best means for dressing belts is often a subject of discussion at a plant. For years, castor oil was considered desirable for rubber belts. Certain leather belt dressings, moreover, were used on rubber with inefficient and usually harmful results. The thing that made oil effective on leather—namely, its ability to lubricate the entire thickness—often made for ruinous results when it was applied to rubber. The B. F. Goodrich Company, Akron, Ohio, has developed a new liquid dressing which merely softens the rubber surface and does not penetrate and cause deterioration in the body. It is said to be safe and easy to apply and to increase pulley grip and horsepower delivery for a longer time than previously attained. These facts were ascertained after tests in which samples of ten-ply rubber dressing were immersed in various liquids for 28 days at room temperature.

A Giant Bearing

Literally man-sized in that a man can walk through it is the giant bearing, one of several, made by the Timken Roller Bearing Company, of Canton, Ohio. It is intended for use in a cement mill. It is designed to carry a load of over a million pounds and it weighs over 2¾ tons. It contains 78 tapered rollers in two rows.

Details of Some Chain Feeders in Australia

	Ore			Chain						
				Tumbler						
Mine	Class	Max. Size, In.	Feed Tons per Hour	Drive	Speed, R/M	Length	Links	Speed Ft./ Min.	Power, Hp.	Cost of Feeding, Cents /Ton
Mount Lyell.....	Copper-silver-gold	12	750 (per day)	Electric motor and worm gear	10	Six of 23½ ft.	30, 8½ by 14½ in. by 2¾ in. thick	65	5 (maximum)	0.2
North Broken Hill..	Lead-silver-zinc	10 by 12	50	Belt and gear	7	Four of 19½ ft.	28, 13 in. long by 24½ in. thick	32	1	.....
Wiluna (1).....	Gold	10	130	Crusher shaft to cone pulley and double-gear train	1.5	Five of 28½ ft.	34, 2½ in. thick weighing 45½ lb. each	7½	4	....
Wiluna (2).....	Gold	4	50	3-hp. motor with v-belt drive to shaft, cone pulleys and double-gear train	3	Five of 14¾ ft.	22, 2 in thick weighing 24 lb.	8	2	0.074

INDUSTRIAL NOTES

Baldwin Locomotive Works, Philadelphia, has assumed all sales and engineering of the Whitcomb Locomotive Company's products and engineering and will establish an internal-combustion locomotive section of its sales department. The Whitcomb plant will continue to make its regular products at Rochelle, Ill.

Poole Foundry & Machine Company, Woodberry, Baltimore, Md., is now the sole owner of all domestic and foreign patents covering and pertaining to the Poole (all metal-gear lubricated) flexible shaft coupling.

Institute of Makers of Explosives has just completed the drafting of instructions and rules for consumers of explosives relative to transportation, storing, handling, and use. These instructions have been issued in leaflet form.

Denver Equipment Company, Denver, Colo., has opened a New York office at 50 Church St. It will be under the direction of John M. Davis.

L. S. Stephens has succeeded D. B. Pierson as president of Stephens-Adamson Manufacturing Company, Aurora, Ill. Mr. Pierson has become chairman of the board.

Bulletins

Geophysical Prospecting. American Askania Corporation, Houston, Tex. Bulletin on new seismic reflection equipment. Pp. 12.

Dredge Bucket Pin. Hadfields, Ltd., Sheffield, England. Leaflet covering the Templeton pin. Pp. 2.

Hydraulic Packings. Chicago Belting Co., Chicago. Folder on correct design. Pp. 4.

Power Transmission. Falk Corporation, Milwaukee, Wis. Bulletin 272, Motoreducers. Pp. 36.

Drill Steel. Edgar Allen & Co., Ltd., Sheffield, England. "Mining Drill Steel Book." Pp. 24.

Welding. Rich Manufacturing Co., 3851 Santa Fe Ave., Los Angeles, Calif. Booklet on Stroco rods and electrodes. Pp. 16.

Flotation. Denver Equipment Co., Denver, Colo. Bulletin 3421, Denver unit flotation cell. Pp. 2. Also bulletins on diaphragm suction pumps, thickeners, and steel and wood tanks, respectively.

Steam Power Plant. Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa. Catalog WG 1803. Yarway water columns and gages.

Rock Drills. Chicago Pneumatic Tool Co., New York. Catalog on CP-52 heavy sinker drill, dry and wet. Pp. 4.

Filtration. Filtration Equipment Corporation, New York. Pamphlet covering filters of the following types: rotary vacuum, open-tank leaf, rotary vacuum dewaterers, and magnetite up-flow sand. Pp. 8.

Power for Mines. Crossley Bros., Manchester, England. A recent issue of "Crossley Chronicles" contains an article describing various Crossley-Premier engine installations at mines in Australia, Cyprus and the Malay States.

SUMMARY OF

MONTHLY COMMENT . . . DAILY AND AVERAGE MONTHLY

TRADING in major non-ferrous metals during September fell far short of expectations, reflecting growing uncertainty over the future of NRA and the lack of confidence in the Government's policies. Prices were irregular, lead, zinc, and tin moving slightly lower, the latter selling off largely on developments in sterling. Silver, in the open market, advanced moderately on the recent action in Washington nationalizing domestic supplies. The price of copper was maintained in this country on assurances that primary producers stood ready to give right-of-way on current sales to custom smelters. Talk of a higher domestic market for the near future has dried up. Copper abroad continued weak.

The United States Copper Association met in New York Sept. 27 to review the position of the metal. The recent decline in demand for new copper, coupled with the conservative purchasing policy of important consumers, raised the question of balancing production and consumption. The feeling prevailed that the favorable trend in the domestic statistics that has been so evident for several months past may be halted and possibly reversed. As a result of the meeting, the principle was approved that production of new copper should be kept up to the highest point possible in relation to consumption to provide for as much employment as possible, but that if future consumption falls below the "book" of 30,750 tons per month, steps be taken to reduce production.

According to E. T. Stannard, president of the association, "It was the unanimous opinion that the continuation of the Copper Code is essential to the orderly conduct of the industry, and in order to eliminate any possibility of a situation developing under which a deficit might be accumulated and the Sales Plan of the Code become inoperative, primary producers suspended sales allocations for the period from Sept. 15 to Oct. 31. During that time all current sales are to be allocated to secondary, custom, and byproduct copper and only when these quotas have been filled will sales be allocated to primary producers. This arrangement will assure the continuation of the Sales Plan of the Copper Code and also a continuation of the present stability of the market."

The *E.&M.J.* index of non-ferrous metal prices for September was 70.46, against 70.86 in August.

United States Market

	Electrolytic Copper			Straits Tin	Lead		Zinc
	Domestic		Export	New Yotk	New York	St. Louis	St. Louis
Sept.	(a)	(b)	(c)				
1	9.00	8.775	6.750	51.600	3.75	3.60	4.200@4.225
3	Holiday		6.725		Holiday		
4	9.00	8.775	6.725	51.950	3.75	3.60	4.200
5	9.00	8.775	6.725	51.625	3.75	3.60	4.200
6	9.00	8.775	6.725	51.450	3.70@3.75	3.55@3.60	4.150@4.200
7	9.00	8.775	6.650	51.150	3.70@3.75	3.55@3.60	4.150
8	9.00	8.775	6.650	51.150	3.70@3.75	3.55@3.60	4.150
10	9.00	8.775	6.600	51.400	3.70@3.75	3.55@3.60	4.150
11	9.00	8.775	6.575	51.400	3.70@3.75	3.55@3.60	4.150
12	9.00	8.775	6.575	51.675	3.70@3.75	3.55@3.60	4.150
13	9.00	8.775	6.575	51.700	3.70	3.55	4.100
14	9.00	8.775	6.550	51.675	3.70	3.55	4.000
15	9.00	8.775	6.525	51.675	3.70	3.55	4.000
17	9.00	8.775	6.525	51.450	3.70	3.55	4.000
18	9.00	8.775	6.525	51.375	3.70	3.55	4 000
19	9.00	8.775	6.550	51.400	3.70	3.55	4 000
20	9.00	8.775	6.550	51.500	3.70	3.55	3.950@4.000
21	9.00	8.775	6.550	51.550	3.65	3.50	3.950@4.000
22	9.00	8.775	6.550	51.550	3.65	3.50	3.950@4.000
24	9.00	8.775	6.550	51.660	3.65	3.50	3.950@4.000
25	9.00	8.775	6.550	51.450	3.60	3.45	3.950@4.000
26	9.00	8.775	6.550	51.500	3.60	3.45	3.950
27	9.00	8.775	6.475	51.350	3.60	3.45	3.900@3.950
28	9.00	8.775	6.475	51.450	3.60	3.45	3.900
29	9.00	8.775	6.450	51.375	3.60	3.45	3.900
Av. for month		8.775	6.586	51.503	3.685	3.535	4.049
				Averages for Week			
5		8.775	6.746	51.620	3.750	3.600	4.208
12		8.775	6.629	51.371	3.725	3.575	4.154
19		8.775	6.542	51.546	3.700	3.550	4.017
26		8.775	6.550	51.535	3.642	3.492	3.971
				Calendar Week Averages			
1		8.775	6.788	51.604	3.750	3.600	4.231
8		8.775	6.700	51.465	3.735	3.585	4.175
15		8.775	6.567	51.588	3.713	3.563	4.092
22		8.775	6.542	51.471	3.683	3.533	3.988
29		8.775	6.508	51.464	3.608	3.458	3.938

Silver, Gold, and Sterling Exchange New York and London

	Sterling Exchange		Silver		Gold	
		"90-day	(d)			(e) United
Sept.	"Checks"	Demand	New York	London	London	States
1	4.98750	4.98875	49.6250	21.6875	141s 5 d	$35.00
3	Holiday			21.8125	141s 7 d	Holiday
4	5.01000	5.01125	49.6250	21.7500	140s 10½d	35.00
5	5.01500	5.01750	49.5000	21.6250	140s 6½d	35.00
6	4.99500	4.99750	49.5000	21.8125	140s 8 d	35.00
7	4.99375	4.99625	49.5000	21.8125	140s 9½d	35.00
8	5.00125	5.00375	49.5000	21.8750	140s 9 d	35.00
10	4.99625	4.99875	49.5000	21.8125	140s 11½d	35.00
11	5.00500	5.00750	49.2500	21.7500	140s 3½d	35.00
12	5.00500	5.00625	49.2500	21.6875	140s 5½d	35.00
13	5.00750	5.00875	49.2500	21.6875	140s 6½d	35.00
14	5.00750	5.01000	49.3750	21.6875	140s 6½d	35.00
15	5.01000	5.01250	49.3750	21.8125	140s 5 d	35.00
17	5.00500	5.00750	49.3750	21.7500	140s 5½d	35.00
18	5.00500	5.00750	49.3750	21.7500	140s 6 d	35.00
19	5.00375	5.00750	49.5000	21.8125	140s 8 d	35.00
20	4.99250	4.99500	49.5000	21.8750	140s 9 d	35.00
21	4.99125	4.99375	49.3750	21.8750	140s 11½d	35.00
22	4.99500	4.99875	49.3750	21.8750	140s 10 d	35.00
24	4.98500	4.98875	49.3750	21.9375	140s 11 d	35.00
25	4.97000	4.97250	49.5000	22.0625	141s 2½d	35.00
26	4.96625	4.96875	49.5000	22.3125	141s 3 d	35.60
27	4.96000	4.96375	49.6250	22.3750	141s 4½d	35.00
28	4.97500	4.97875	50.0000	22.4375	141s ½d	35.00
29	4.96000	4.96375	49.8750	22.3125	141s 1½d	35.00
Av. for month	4.99344	.....	49.484	21.888	.....	35.00
			Averages for Week			
5	5.00575	.....	49.600	.....	.....	.....
12	4.99938	.....	49.417	.....	.....	.....
19	5.00646	.....	49.375	.....	.....	.....
26	4.98333	.....	49.438	.....	.....	.....

Calendar week averages: New York Silver, Sept. 1st, 49.625; 8th, 49.525; 15th, 49.333; 22d, 49.417; 29th, 49.646.

(a) Quotation issued by the Code Authority for copper offered for sale in the domestic market pursuant to the provisions of the Copper Code.

(b) Net prices at refineries on the Atlantic seaboard, being Code Authority prices, less delivery and interest charges of 0.225c. per lb. which is the average differential for delivery in New England.

(c) Export quotations for copper are net prices at refineries on the Atlantic seaboard and include sales of domestic copper in the foreign market. The c.i.f. Hamburg, Havre, and Liverpool basis commands a premium of 0.300c. per pound above our f.o.b. refinery quotation.

Excepting "Blue Eagle" copper, the above quotations are our appraisal of the major United States markets, based on sales reported by producers and agencies. All prices are in cents per pound.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is quoted at 0.35c. per pound above St. Louis, this being the freight differential. Contract prices for High-Grade zinc delivered in the East and Middle West in nearly all instances command a premium of 1c. per pound over the current market for Prime Western but not less than the *E. & M. J* average for Prime Western for the previous month.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

(d) Silver other than newly mined domestic. Under Executive order issued Dec. 31 1933, the U. S. Government price on newly mined domestic silver was established at 64½c. per troy ounce.

(e) U. S. Treasury's gold price.

THE MARKETS

PRICES OF METALS . . . MISCELLANEOUS QUOTATIONS

London Market

	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
Sept.	Spot	3 Mo.	(Big)	Spot	3 Mo.	Spot	3 Mo.	Spot	3 Mo.
3	27.8750	28.2500	31.0000	229.8750	228.5000	10.4375	10.7500	13.3750	13.5625
4	28.0000	28.3750	31.0000	230.1250	228.8750	10.5000	10.8125	13.3125	13.5625
5	27.9375	28.2500	31.0000	228.7500	227.7500	10.5000	10.7500	13.1875	13.5000
6	28.0000	28.3750	31.0000	229.2500	228.2500	10.4375	10.7500	13.0625	13.3750
7	27.8125	28.1250	31.0000	228.2500	227.5000	10.3750	10.6875	12.8750	13.1875
10	27.3750	27.6250	30.5000	229.0000	227.1250	10.1875	10.5000	12.6875	12.9375
11	27.3125	27.6250	30.5000	228.0000	226.3750	10.0000	10.3750	12.5625	12.7500
12	27.4375	27.7500	30.5000	228.8750	227.1250	10.0625	10.4375	12.3750	12.5625
13	27.3750	27.6250	30.2500	229.8750	227.2500	10.2500	10.5000	12.5625	12.6875
14	27.3125	27.5625	30.2500	229.2500	227.1250	10.2500	10.5000	12.5625	12.6875
17	27.2500	27.5625	30.5000	228.5000	227.0000	10.2500	10.4375	12.4375	12.5625
18	27.3125	27.6250	30.2500	228.7500	227.0000	10.2500	10.4375	12.2500	12.4375
19	27.5000	27.7500	30.3750	228.7500	227.1250	10.3125	10.5000	12.3750	12.5625
20	27.5625	27.8750	30.5000	230.2500	228.0000	10.5000	10.6250	12.5000	12.6875
21	27.5000	27.8125	30.5000	230.5000	227.7500	10.5000	10.6250	12.5000	12.6875
24	27.5000	27.7500	30.5000	231.6250	228.3750	10.6250	10.7500	12.3750	12.6250
25	27.5625	27.8750	30.5000	232.5000	229.0000	10.5625	10.6875	12.3750	12.6250
26	27.4375	27.7500	30.5000	232.8750	229.0000	10.6250	10.7500	12.5000	12.6875
27	27.4375	27.6875	30.2500	231.2500	227.7500	10.6250	10.7500	12.5000	12.6250
28	27.3125	27.5625	30.2500	231.5000	228.5000	10.5000	10.6250	12.5000	12.6250
Av. for month	27.541	.....	30.556	229.888	.....	10.388	10.613	12.644	12.847

Current Prices—Miscellaneous Metals, Ores, and Non-Metallic Minerals

Quotations cover wholesale lots, prompt shipment, f.o.b. New York, unless otherwise stated.

(Oct. 1, 1934)

Miscellaneous Metals

Aluminum, ingot, 99 per cent plus, lb.	23.30c.
Antimony, domestic and Chinese (duty paid), lb.	8.875c.
Bismuth, ton lots, lb.	$1.20
Cadmium, lb.	55.00c.
Chromium, 97 per cent grade, lb.	88.00c
Nickel, electrolytic cathodes, lb	35.00c.
Magnesium, 99.8 per cent, carloads, lb.	30.00c.
Palladium, troy oz.	$24.00
Platinum, (official quotation) troy oz.	$36.00
Quicksilver, flask of 76 lb.	$74.00@$75.00
Radium, mg. radium content	$50.00
Selenium, 99.5 per cent, lb.	$1.80
Silicon, minimum 97 per cent, spot, lb.	16.50c.
Tellurium, lb.	$2.00
Thallium, 100 lb. or more, lb.	$6.50
Titanium, 96 to 98 per cent, lb.	$6.00
Zirconium, commercially pure, lb.	$7.00

Metallic Ores

Beryllium Ore, f.o.b. mines, ton	$30.00@$35.00
Chrome Ore, 45@47 per cent, c.i.f., long ton	$16.00@$16.50
Iron Ore, Lake Superior, long ton:	
Old Range bessemer	$4.80
Mesabi, bessemer	$4.65
Old Range, non-bessemer	$4.65
Mesabi, non-bessemer	$4.50
Lead (Galena) 80 per cent, Joplin, Mo., ton	$32.00@$34.50
Manganese Ore, long ton unit:	
52@55 per cent	26c.
49@51 per cent	24@25c.
44@47 per cent	23c.
Molybdenum Ore, per lb. of contained MoS_2	42c.
Tungsten Ore, per unit of WO_3:	
Chinese duty paid	$16.50@$17.00
Domestic Scheelite	$16.50@$17.00
Vanadium Ore, per lb. of contained V_2O_5	26c.
Zinc Ore, Prime, 60 per cent concentrate, Joplin, Mo.; per ton.	$23.00

Metallic Compounds

Arsenious Oxide (arsenic) lb.	3½c.
Cobalt Oxide, 70@71 per cent, lb.	$1.35
Copper Sulphate, 100 lb.	$3.85
Sodium Nitrate, ex vessel, in 200-lb. bags, per 100 lb.	$1.24
Sodium Sulphate, bulk ton	$13.00@$15.00

Alloys

Beryllium-Copper, 12.5 per cent Be, 51 to 200 lb., lb.	$3.81
Ferrochrome, 65@70 per cent chromium, 4@6 per cent carbon, lb.	10c.
Ferromanganese, 78@82 per cent, gross ton	$85.00
Ferromolybdenum, 50@60 per cent Mo, lb. of Mo contained	95c
Ferrosilicon, 50 per cent, gross ton	$77.50
Ferrotungsten, 75@80 per cent, lb. of W contained	$1.35@$1.45

Non-Metallic Minerals

Asbestos, f.o.b. mines, ton:	
Canadian (Quebec)	
Crude No. 1	$450@.....
Crude No. 2	$200@$225
Spinning fibers	$90@$135
Paper stock	$32@ $37
Shorts	$11@ $15
Vermont	
Shingle stock	$45@.....
Paper stock	$35@.....
Cement stock	$23@.....
Barytes, long ton:	
Georgia, crude	$7@.....
Missouri, 95 per cent $BaSO_4$, 1 per cent iron	$5@.....
Bauxite, long ton:	
Domestic, chemical, 55@58 per cent	$6@ $7.50
Domestic, abrasive, 78@84 per cent	$12.50@$15.00
Dalmatian, 50@55 per cent	(a) $4.50@ $6.00
French, 56@59 per cent	(a) $5.50@ $6.50
China Clay, f.o.b. mines ton:	
South Carolina and Georgia, bulk	$5.00@ $6.50
Delaware, No. 1	$14.00@.....
Feldspar, bulk, ton:	
Potash feldspar, 200 mesh	$17.00
Glass-spar, white, 20 mesh	$11.50
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois 85-5 per cent, all rail movement, ton	@$16.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton:	
Dead-burned, f.o.b. California	$25.00@.....
Dead-burned, f.o.b. Washington	$22.00@.....
Mica, per lb., North Carolina, No. 1 and 2 quality:	
1½x2in.	15@30c.
2x2in.	30@50c.
2x3in.	50@65c.
3x4in.	90@ $1.25
4x6in.	$1.50@ $2.50
White, ground, 70 mesh, ton	$60.00@$80.00
Ocher, Georgia, ton	$19.00@$22.50
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	(a) 12@ 12½c
Silica, water-floated, in bags, 325 mesh, ton	$16.00@$40.00
Sulphur, Texas mines, long ton	$18.00@.....
Talc, f.o.b. works, ton:	
New York, double air-floated, 325 mesh	$12.00@$15.00
New Jersey, mineral pulp	$8.00@$10.00
Vermont, extra white, 200 mesh	$8.50@ $9.00
Tripoli, Missouri, ton:	
40 mesh, cream colored	$16.00@.....
200 mesh, cream colored	$26.00@.....

(a) Nominal.

Iron and Steel

Pig Iron, Valley furnaces, gross ton:	
Bessemer	$19.00
Basic	$18.00
No. 2 Foundry	$18.50
Steel, base prices, Pittsburgh:	
Billets and Sheet bars, gross ton	$27.00
Structural shapes, 100 lb.	$1.80
Bars, 100 lb.	$1.80

MONTHLY AND YEARLY AVERAGE PRICES

Silver and Sterling Exchange

	New York		London Spot		Sterling Exchange	
	1933	1934	1933	1934	1933	1934
January	25.400	44.188	16.883	19.382	336.060	504.644
February	26.074	45.233	16.885	20.073	342.114	503.085
March	27.928	45.875	17.588	20.278	343.138	509.259
April	30.730	45.180	18.440	19.740	357.565	515.210
May	34.072	44.226	19.046	19.276	393.106	510.510
June	35.663	45.173	19.078	19.981	413.216	504.721
July	37.630	46.310	18.341	20.512	464.760	503.990
August	36.074	48.986	17.877	21.377	449.944	506.398
September	38.440	49.484	18.272	21.888	466.240	499.344
October	38.190		18.221		466.380	
November	42.974		18.428		514.573	
December	43.550		18.674		511.260	
Year	34.727		18.144		421.530	

New York quotations for silver not eligible for sale to U. S. Government, cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine. Sterling exchange in cents.

Copper

	F.O.B. Refinery			London Spot			
	Electrolytic					(a)	
	Domestic		Export	Standard		Electrolytic	
	1933	1934	1934	1933	1934	1933	1934
January	4.775	7.890	7.831	28.557	32.560	33.244	35.614
February	4.775	7.777	7.844	28.481	33.072	32.556	35.969
March	5.011	7.775	7.837	28.179	32.497	32.370	35.512
April	5.395	8.173	8.053	29.576	33.006	33.681	36.038
May	6.698	8.275	7.913	34.071	32.662	38.163	35.756
June	7.773	8.594	7.705	36.759	32.149	41.000	35.339
July	8.635	8.775	7.146	37.917	29.707	41.524	32.778
August	8.768	8.775	6.885	36.071	28.358	40.227	31.483
September	8.753	8.775	6.586	35.122	27.541	38.339	30.556
October	7.950			33.656		36.977	
November	7.881			30.588		33.898	
December	7.885			31.306		34.329	
Year	7.025			32.524		36.359	

New York quotations, cents per pound. London, pounds sterling per long ton. (a) Bid quotation.

Lead

	New York		St. Louis		London			
	1933	1934	1933	1934	1933	1933	1934	1934
					Spot	3 Mos.	Spot	3 Mos.
January	3.000	4.000	2.875	3.900	10.458	10.833	11.304	11.517
February	3.000	4.000	2.875	3.900	10.431	10.719	11.634	11.913
March	3.146	4.000	3.021	3.900	10.609	10.821	11.545	11.842
April	3.260	4.179	3.135	4.042	10.872	11.122	11.500	11.794
May	3.654	4.140	3.525	3.990	12.095	12.372	11.051	11.341
June	4.173	3.975	4.023	3.825	13.280	13.571	11.054	11.253
July	4.452	3.772	4.303	3.623	13.411	13.613	10.813	11.045
August	4.500	3.747	4.350	3.597	12.182	12.457	10.821	11.028
September	4.500	3.685	4.350	3.535	11.932	12.229	10.388	10.613
October	4.313		4.176		11.804	12.102		
November	4.288		4.146		11.537	11.778		
December	4.141		4.042		11.431	11.658		
Year	3.869		3.735		11.670	11.940		

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Tin

	New York		London	
	1933	1934	1933	1934
	Straits		Standard, Spot	
January	22.692	51.891	145.708	226.631
February	23.500	51.668	148.544	226.731
March	24.221	53.838	149.120	233.863
April	27.136	55.622	157.944	239.181
May	36.051	53.541	186.207	234.239
June	44.097	51.271	219.964	226.875
July	46.356	51.930	216.673	230.381
August	44.794	51.953	215.210	228.114
September	46.665	51.503	216.893	229.888
October	47.858		223.455	
November	53.011		226.722	
December	52.936		227.678	
Year	39.110		194.510	

New York quotations, cents per pound. London, pounds sterling per long ton.

Zinc

	St. Louis		London			
	1933	1934	1933	1933	1934	1934
			Spot	3 Mos.	Spot	3 Mos.
January	3.018	4.271	14.381	14.595	14.688	14.943
February	2.666	4.384	13.866	14.119	14.844	15.125
March	2.987	4.368	14.647	14.674	14.735	15.033
April	3.298	4.370	14.951	15.208	14.916	15.200
May	3.805	4.346	15.505	15.660	14.722	14.966
June	4.348	4.240	16.988	16.774	14.241	14.467
July	4.878	4.317	17.795	17.789	13.465	13.693
August	4.916	4.281	16.869	17.031	13.682	13.756
September	4.699	4.049	16.810	17.042	12.644	12.847
October	4.748		16.310	16.599		
November	4.520		15.048	15.349		
December	4.461		14.826	15.059		
Year	4.029		15.666	15.825		

St. Louis quotations, cents per pound; London, pounds sterling per long ton.

Cadmium and Aluminum

	Cadmium		Aluminum	
	1933	1934	1933	1934
January	55.000	55.000	23.300	23.300
February	55.000	55.000	23.300	23.300
March	55.000	55.000	23.300	23.300
April	55.000	55.000	23.300	23.300
May	55.000	55.000	23.300	23.300
June	55.000	55.000	23.300	23.300
July	55.000	55.000	23.300	23.300
August	55.000	55.000	23.300	23.300
September	55.000	55.000	23.300	23.300
October	55.000		23.300	
November	55.000		23.300	
December	55.000		23.300	
Year	55.000		23.300	

Aluminum in cents per pound, 99 per cent grade.
Cadmium, cents per pound.

Antimony, Quicksilver, and Platinum

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) New York	
	1933	1934	1933	1934	1933	1934
January	5.722	7.198	48.500	67.538	26.480	38.000
February	5.738	7.172	48.614	72.011	24.000	38.000
March	5.901	7.545	52.676	75.472	24.667	38.000
April	5.876	7.918	54.580	75.930	26.800	38.000
May	6.264	8.465	56.500	75.577	28.500	36.538
June	6.500	7.900	60.038	75.000	30.000	36.000
July	7.262	8.024	62.900	75.000	32.320	36.000
August	6.986	8.514	63.500	75.000	33.000	36.000
September	6.880	8.745	64.580	74.563	34.560	36.000
October	6.843		66.500		36.000	
November	7.113		66.000		37.583	
December	7.250		66.330		38.000	
Year	6.528		59.227		30.993	

(a) Antimony quotations in cents per pound, for ordinary brands. (b) Quicksilver in dollars per flask o.76 lb. (c) Platinum in dollars per ounce troy.

Pig Iron

	Bessemer		Basic		No. 2 Foundry	
	1933	1934	1933	1934	1933	1934
January	14.50	18.00	14.00	17.00	14.50	17.50
February	14.50	18.00	14.00	17.00	14.50	17.50
March	14.50	18.00	14.00	17.00	14.50	17.50
April	14.50	18.48	14.00	17.48	14.50	17.98
May	15.42	19.00	14.42	18.00	14.92	18.50
June	16.00	19.00	15.00	18.00	15.50	18.50
July	16.50	19.00	15.50	18.00	16.00	18.50
August	17.00	19.00	16.00	18.00	16.50	18.50
September	18.00	19.00	17.00	18.00	17.50	18.50
October	18.00		17.00		17.50	
November	18.00		17.00		17.50	
December	18.00		17.00		17.50	
Year	16.24		15.41		15.91	

Iron in dollars per long ton. F.o.b. Mahoning and Shenango Valley furnaces